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CONTENTS

FIGURES

1.0 INTRODUCTION

The Dynamic Economic Values Model (DYNEVAL) uses Lagrange Dynamic Programming to chart through time the optimal trajectory of an economy which has either been disrupted in some way, or in which people have changed their value structure (e.g., by giving more emphasis to leisure or the military). "Optimal trajectory" is that time-dependent mix of investment and production activities which allows consumers (people, government, military, etc.) to maximize over time a sum of value functions. Too much early investment causes people in early time periods to have too low a standard of living based on their value functions; too little investment causes the economy to recover too slowly.

The basic logic flow of the model is shown in Fig. 1-1. Since each problem the model solves is different, a storage allocator is used to parse a large storage array into a series of smaller data arrays of appropriate dimensions for the problem. The basic data for the problem, including current activity levels and a direct requirements matrix, are then input to the program which proceeds to calculate both the current day economy and the final equilibrium economy. In some studies, one does not care about the trajectory to equilibrium, but rather only about the final equilibrium economy itself. In these cases, the model may be stopped here.

Once the above is accomplished, the model starts its real job of calculating the optimal investment, production, and consumption activity levels which gradually move the economy to its equilibrium state. This is done by optimizing each time period in turn and propagating the capital resources produced forward in time, taking into account population growth, gestation time, depreciation, etc. Each time period is presented with a set of capital which the past has made available to it, and a set of capital values which the future is willing to pay. From these, and internal requirements detailed later, the single time period produces,

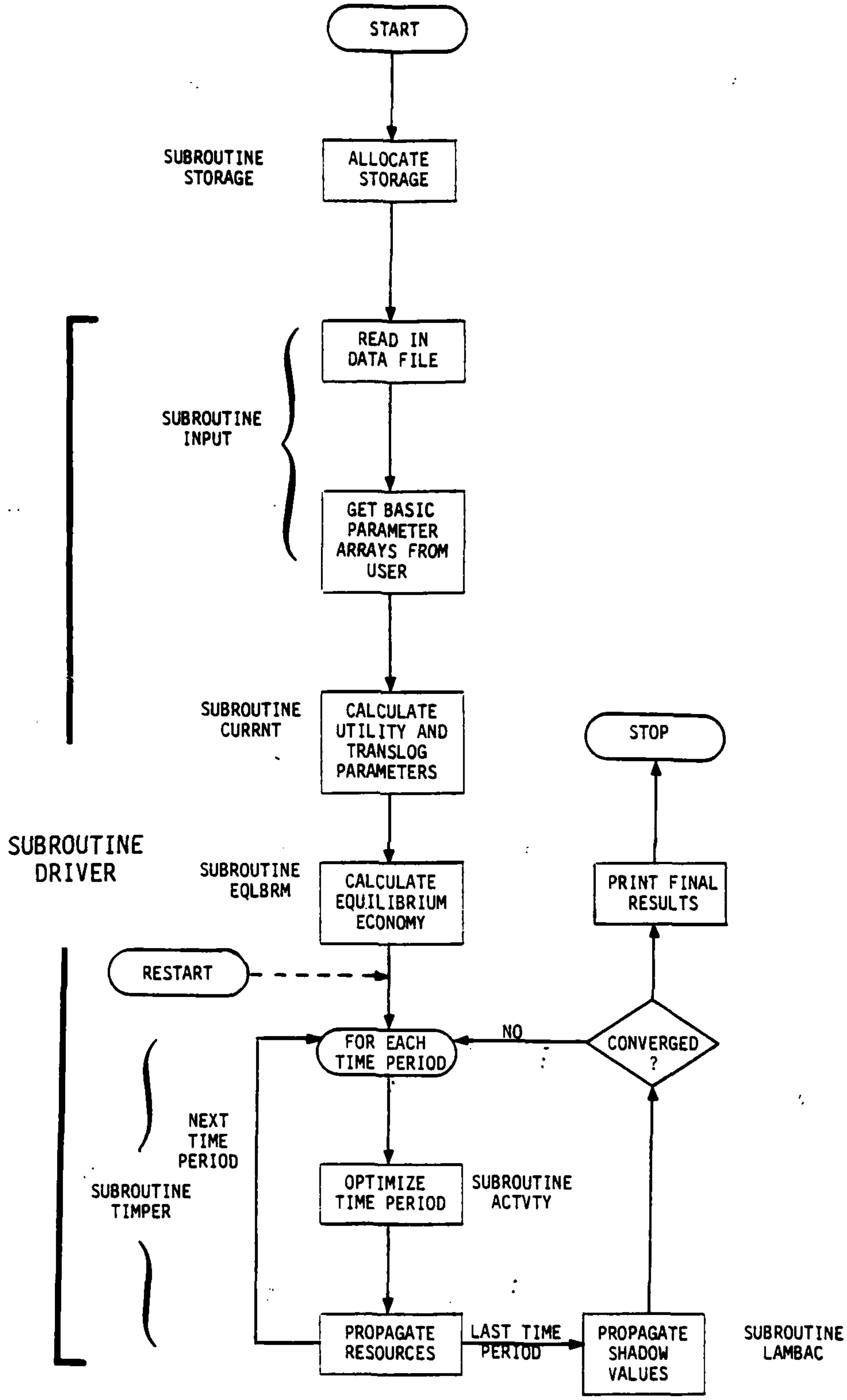


Figure 1-1. Logic Flow of Economic Model

invests, and consumes in an optimal way. As each time period considers its options it automatically assigns a rental (shadow) value to the capital and labor needed to produce the goods and services for this time period. These rental values can then be propagated backward in time (taking into account discount values, population growth, gestation times, etc.) to give each time period a more realistic view of the future. Each time period is then reoptimized taking into account this new information and new capital passed to it by the past and the process is repeated.

The following sections give the mathematical details of each stage of the program. These are technical in nature and intended for use by someone interested in understanding the precise way the model operates or interested in making changes to the model. For the person interested in using the model as a research tool, Appendix A is a user's manual explaining how to run the model and giving examples of output appearing on the terminal screen and the line printer. Appendix B is a description of the companion program, AGGRAT, used to aggregate economic data and put it into model format. Definitions of all pertinent variables and arrays are given in Appendix C. Appendix D is a complete listing of the source code for the model.

2.0 FUNDAMENTAL RELATIONS

Throughout the course of the program certain variables are known and others must be calculated. In the single time period optimizer, e.g., the amount of capital resources available for production is known. In the equilibrium calculation the production and investment activities are known as a simple function of the resources, and the rental value for capital is known as a simple function of its cost. In order to calculate missing quantities certain fundamental relationships among resource levels, activity levels, costs, prices, and values need to be derived. This section details relationships among these variables for the production and consumption activities. In addition, other relations are valid when the economy is in equilibrium. These will be discussed in Sec. 5. Investment and trade activities present special problems and will be discussed in Sec. 6.

2.1 FUNDAMENTAL VARIABLES

The following is a list of the fundamental variables. Other subsidiary variables will be defined as they occur. Superscripts refer to types of activities, i.e., production, investment (production of capital), or consumption, and are not dummy indices.

K_j = Inventory level of capital resource j. These are physical items (machines, etc.) and may be used only in the production of a single consumable

K_i^{eff} = "Effective level" (explained later) of the total capital mix used to produce consumable i. To reduce cumbersome notation the "eff" will sometimes be omitted in this text. The subscript i will implicitly refer to K_i^{eff}, while the subscript j will refer to a particular capital resource K_j

L_i = Amount of labor used in the production of consumable i

L = Total labor pool

X_i^p = Activity level for production of consumable i

X_i^c = Activity level for the ith consumption activity. This activity need not consume any of consumable i, nor is it restricted to consuming only one consumable. Rather it is defined as the consumption of any particular group of consumables by any or all of a group of consumers (people, government, etc.).

X_j^I = Activity level for investment, i.e., the production of capital resource j

Λ_i^I = Value of the effective capital needed to produce consumable i

Λ_{K_j} = Value of capital resource j

Λ_i = Price of consumable i

λ_{K_j} = Rental value of capital resource K_j

λ_L = Rental value of labor. It has the same value regardless of the activity

There are three basic types of activities: production (X_i^p), consumption (X_i^c), and investment (X_i^I). The production activities require capital, labor, and a specified mix of various consumables. Each production activity produces only one type of consumable and each consumable is produced by only one type of production activity. Consumption activities require no capital and no labor (except consumption of leisure which requires only labor), but do require a specified mix of consumables. The same consumable may be used in several different

consumption activities. I v͜ ͜ ument activities produce capital. They require no labor but do require a specified mix of consumables. The investment activities are, in effect, bookkeeping activities whereby various consumables are turned into a single capital resource specific to a given production activity. The labor required to produce the capital is implicit in the labor required to produce the ccnsumables wed to create the capital.

2.2 BASIC ASSUMPTIONS

In order to calculate any relations among the above listed variables, certain assumptions must be made about how the economy responds to changes in prices, supply, or demand. The following assumptions are basic to the model. In some cases these assumptions are given functional form. Where the form and its implications are spread throughout the model, as opposed to a localized function which could easily be changed in the model, it will be noted as such.

1. Consumption activity levels vary inversely with cost. The higher the cost of the consuming activity, the lower the level of the activity. If consumption activity i uses α_{ij} of consumable j per unit activity, then its cost, C_i, is given as:

$$C_i = \sum_j \alpha_{ij} \Lambda_j \tag{2-1}$$

In the model Assumption 1 is given functional form by defining the consumption activity level as:

$$X_i^C = \left(\frac{\Gamma_i}{C_i} \right)^{1/b_i} \tag{2-2}$$

where Γ_i = normalization constant (based on current economy) and b_i = elasticity of demand factor.

The exact form of Eq. 2-2 is not required by the model. However, this form is a particularly simple yet useful way of expressing Assumption 1. It is equivalent to defining a utility for consumption activity i of the form

$$U(X_i^c) = \Gamma_i \frac{X_i^{c\,(1-b_i)} - 1}{1 - b_i} , \quad b_i \neq 1 \tag{2-3a}$$

$$= \Gamma_i \ln (X_i^c) , \qquad b_i = 1 \tag{2-3b}$$

and stating that X_i^c is the level where the marginal utility, dU/dX_i^c, is equal to the cost. Usually b_i is set equal to 1.0. For this value of b_i, doubling the activity level results in the same increment of utility regardless of the original value. It states, for example, that two people whose salaries are doubled experience the same increase in happiness regardless of their original salaries. Values of b_i between 0.5 and 2.0 seem to be most reasonable.

2. The production of consumable i may be considered a function of capital and labor alone: $X_i^p = f(K_i^{eff}, L_i)$. Furthermore, capital and labor may be traded for one another in the production of any consumable according to a particular relation known as the translog function (also called the "constant elasticity function"):

$$X_i^p = g_i \left[\gamma_{K_i} K_i^{-\beta_i} + \gamma_{L_i} L_i^{-\beta_i} \right]^{-1/\beta_i} \tag{2-4}$$

where g_i = normalization constant (based on current economy)

$\gamma_{K_i} + \gamma_{L_i} = 1.0$

$\frac{1}{\beta_i + 1}$ = elasticity of substitution

The implications of the translog function, e.g., its homogeneity $[X_i^p(aK, aL) = aX_i^p(K,L)]$, are spread throughout the model. It would be difficult to change to another production function.

3. Capital is used in place of labor where capital is cheaper, and labor is used in place of capital where labor is cheaper. That is, capital and labor are traded one for the other until the value of their marginal products are equal. This assumption is expressed mathematically as:

$$\lambda_{K_i} = \left(\lambda_L \frac{\partial X_i^p / \partial K_i^{eff}}{\partial X_i^p / \partial L_i} = - \lambda_L \frac{dL_i}{dK_i^{eff}} \right)_{X_i^p = \text{constant}} \tag{2-5}$$

4. The price of any consumable is equal to the average unit cost of producing it, i.e.,

$$\Lambda_i = \frac{K_i \lambda_{K_i} + L_i \lambda_L + \sum_j X_i^p \alpha_{ij} \Lambda_j}{X_i^p} \tag{2-6}$$

where α_{ij} = fixed amount of consumable j required to produce one unit of consumable i.

While capital and labor are traded one for the other in production activities, there exists no mechanism in the model for substituting one consumable for another, i.e., the α_{ij} in Eq. 2-6 are fixed for the given problem.

2.3 DERIVED RELATIONS

The following relationships are derived from the basic assumptions. Their use in the model will be discussed in later sections.

1. Assumption 1 allows an independent calculation of λ_L, the rental value of labor. For the form of Assumption 1 described by Eq. 2-2,

$$\lambda_L = \frac{\Gamma_{Leisure}}{(L - \sum_i L_i)^{b_{Leisure}}} \tag{2-7}$$

since the cost of leisure is equal to the cost of labor.

2. Differentiating the translog function of Assumption 2 (Eq. 2-4) and substituting it in Eq. 2-5 of Assumption 3 yields a relation between the ratio of capital to labor and the ratio of their rental values:

$$\left(\frac{K_i}{L_i}\right)^{\beta_i+1} = \frac{\gamma_{K_i}\lambda_L}{\gamma_{L_i}\lambda_{K_i}} \tag{2-8}$$

3. The fair price assumption, Assumption 4, may be written as:

$$\Lambda_i' X_i^p = K_i\lambda_{K_i} + L_i\lambda_L \tag{2-9}$$

where $$\Lambda_i' = \Lambda_i - \sum_j \alpha_{ij}\Lambda_j$$

stating that value added is divided between capital and labor. Equations 2-4 and 2-8 may be substituted in Eq. 2-9 to yield:

$$L_i = K_i \left[\frac{\gamma_{L_i}}{\left(\frac{\lambda_{K_i}}{g_i\gamma_{K_i}\Lambda_i'}\right)^{-(\beta_i)/(1+\beta_i)} - \gamma_{K_i}}\right]^{1/\beta_i} \tag{2-10a}$$

$$L_i = K_i \left[\frac{\gamma_{K_i}}{\left(\dfrac{\lambda_L}{g_i \gamma_{L_i} \Lambda_i'}\right)^{-(\beta_i)/(1+\beta_i)} - \gamma_{L_i}} \right]^{-1/\beta_i} \tag{2-10b}$$

or

$$\Lambda_i' = \frac{\lambda_L}{g_i \gamma_L} \left[\gamma_K \left(\frac{L_i}{K_i} \right)^{\beta_i} + \gamma_L \right]^{\frac{\beta+1}{\beta}} \tag{2-10c}$$

3.0 <u>REQUIRED INPUT DATA</u>

The model expects the following data to be input at the start of the model. The first five items describe the given economy directly and cannot be changed within the model. The last five are particular to the study at hand and may be changed for each run.

1. Current day activity levels. These include the investment, trade, and consumption activities as well as the production activities.

2. Current day capital resource inventories.

3. Gestation times, depreciation rates, discount rates, and growth rates (above population growth) for all capital resources. These values are usually calculated or input at the time the model data is formed by using the data aggregator AGGRAT, which is described in Appendix B.

4. A direct requirements matrix, α_{ij}, giving the amount of consumable j used per unit of activity i for all activities i mentioned in (1) above.

5. A rental array giving the current mix of capital and labor for each of the production activities.

6. The values of b_i used in the utility function for consumption activities (see Assumption 1, Sec. 2).

7. The fraction of each capital resource which "survived" the proposed disruption.

8. Minimum consumption activity levels. While this array is normally set to zero, it allows the user to specify, e.g., that a minimum of agricultural products <u>must</u> be consumed. By setting the minimum activity level negative, the user allows a zero level of consumption.

9. The ratios of two utility coefficients Γ; those used for the study to the current day Γ values. If no change in priorities is postulated, these ratios are unity.

10. The translog elasticity (see Sec. 4.2) parameters β for both the capital labor trade-offs and, if two types of capital are required, the effective capital calculation.

4.0 CURRENT ECONOMY

While the inventory and activity levels of the current economy are input directly to the model, the utility function and translog coefficients which describe the economy must be calculated. This is done by subroutine CURRNT. The logical flow of CURRNT is diagrammed in Fig . 4-1.

4.1 UTILITY COEFFICIENTS

Equation 2-2 gave the consumption activity level as a function of the cost for that activity.

$$X_i^c = \left(\frac{\Gamma_i}{C_i}\right)^{1/b_i} \qquad (4\text{-}1)$$

The Γ_i are normalized to the current economy. Since physical units are defined as the amount valued at 1.0 in the current economy, $C_i = 1$, and

$$\Gamma_i = (X_i^c - Z_i)^{b_i} \cdot F_i^{\ b_i} \qquad (4\text{-}2)$$

where Z_i = minimum activity level (offset),

F_i = ratio of study economy to current economy priorities,

and X_i^c refers here to the current consumption level.

The parameters b_i are input by the user (see Appendix A).

4.2 TRANSLOG PARAMETERS

Capital and labor may be traded one for the other according to the translog function, Eq. 2-4:

$$X_i^p = g_i \left[\gamma_{K_i} K_i^{-\beta_i} + \gamma_{L_i} L_i^{-\beta_i}\right]^{-1/\beta_i} \qquad (4\text{-}3)$$

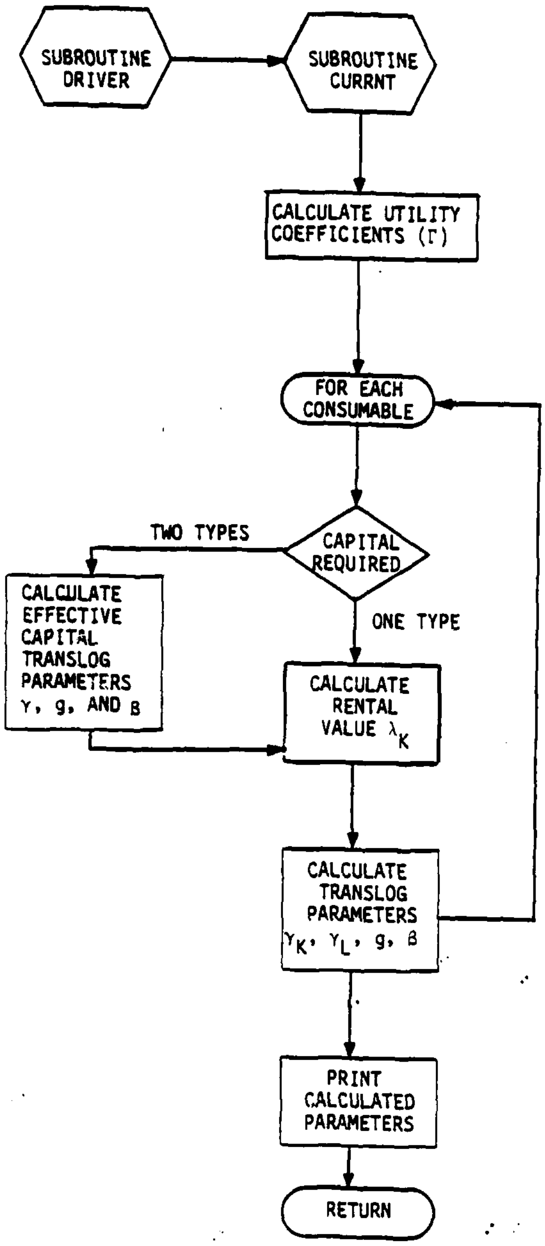


Figure 4-1. Logic Flow of Current Economy Parameter Calculation

The elasticity parameter, β_i, is input directly or indirectly by the user (see 4.2.3 below). The γ's and e_i must be calculated.

4.2.1 <u>Capital and Labor Coefficients γ</u>

Equation 2-8 gave the relation between the ratio of capital and labor and the ratio of their rental values as:

$$\left(\frac{K_i}{L_i}\right)^{\beta_i+1} = \frac{\gamma_{K_i}\lambda_L}{\gamma_{L_i}\lambda_{K_i}} \tag{4-4}$$

In the current economy, $\lambda_L = 1.0$ by definition of the units of labor. The rental value for capital may be found by dividing the total spent by industry i on capital by the total inventory of the capital used by the industry:

$$\lambda_K = \frac{r_j}{K_j} \tag{4-5}$$

where r = amount spent on capital j in the current economy.

Since K_i and L_i are known for the current economy, as well as λ_{K_i} and λ_L, the γ_{K_i} and γ_{L_i} may be found from Eq. 4-4 and the fact that their sum must be unity:

$$\gamma_{K_i} = \frac{\lambda_{K_i}(K_i/L_i)^{\beta_i+1}}{\lambda_{K_i}(K_i/L_i)^{\beta_i+1} + \lambda_L} \tag{4-6a}$$

$$\gamma_{L_i} = \frac{1.0}{\lambda_{K_i}\left(\frac{K_i}{L_i}\right)^{(\beta_i+1)} + \lambda_L} \tag{4-6b}$$

4.2.2 Normalization Factor g_i

The parameter g_i is simply the value required to reproduce the current level of activity if the capital and labor used equal that used in the current economy.

$$g_i = \frac{X_i^p}{\left[\gamma_{K_i} K_i^{-\beta_i} + \gamma_{L_i} L_i^{-\beta_i}\right]^{-1/\beta_i}} \qquad (4\text{-}7)$$

4.2.3 Elasticity Parameter β_i

Under most circumstances the elasticity parameter is input by the user. Valid values for β_i lie in the range $-1.0 \leq \beta_i \leq \infty$. If β_i lies outside this range the model assumes the user wants the model to calculate the actual β_i and that the input value refers to the productivity at infinite labor levels. Some industries are able to increase their output significantly by increasing the amount of labor used, e.g., by adding a second shift. Other industries are not. If the user thinks that the most a particular industry could increase its output given fixed capital and unlimited labor is by a factor $p > 1.0$, he may set $\beta_i = -p$, and the model will calculate β_i such that:

$$\frac{g_i \left[\gamma_{K_i} K_i^{-\beta_i} + \gamma_{L_i} (L_i = \infty)^{-\beta_i}\right]^{-1/\beta_i}}{g_i \left(\gamma_{K_i} K_i^{-\beta} + \gamma_{L_i} L_i^{-\beta_i}\right)^{-1/\beta_i}} = p \qquad (4\text{-}8)$$

Equation 4-8 may be rewritten as:

$$\frac{\frac{\gamma_{K_i}}{\gamma_{L_i}} \left(\frac{K_i}{L_i}\right)^{-\beta_i}}{\frac{\gamma_{K_i}}{\gamma_{L_i}} \left(\frac{K_i}{L_i}\right)^{-\beta_i} + 1.0} = p^{-\beta_i} \qquad (4\text{-}9)$$

From Eq. 4-4:

$$\frac{\gamma_{K_i}}{\gamma_{L_i}} = \lambda_{K_i}\left(\frac{K_i}{L_i}\right)^{\beta_i+1} \tag{4-10}$$

Therefore, combining Eq. 4-9 and 4-10:

$$\frac{\lambda_K\left(\frac{K_i}{L_i}\right)}{\lambda_K\left(\frac{K_i}{L_i}\right) + 1.0} = p^{-\beta_i}$$

or

$$\beta_i = \frac{-\ln \dfrac{\lambda_K(K_i/L_i)}{\lambda_K(K_i/L_i) + 1.0}}{\ln p} \tag{4-11}$$

4.2.4 Effective Capital

Normally a given production activity uses one type of capital. The model allows two types of capital per industry, however, and treats the combination as an "effective" level of capital. The two types of capital are combined by a separate translog function:

$$K_i^{eff} = g\left[\gamma_1 K_{j_1}^{-\beta} + \gamma_2 K_{j_2}^{-\beta}\right]^{-1/\beta} \tag{4-12}$$

To avoid cumbersome notation, we will set $K_i^{eff} = K_{eff}$ and "j_1" and "j_2" to "1" and "2" respectively in this section.

Eq. 2-5 may be generalized for this case to derive the relationship between λK_{eff} and the individual rental values:

$$\lambda_{K_j} = \lambda_L \frac{dL}{dK_{eff}} \quad \frac{\partial K_{eff}}{\partial K_j}$$

$$= \lambda_{K_{eff}} \frac{\partial K_{eff}}{\partial K_j}$$

$$= \lambda_{K_{eff}} \gamma_j \, g \left(\frac{K_{eff}}{g K_j}\right)^{\beta+1} \qquad (4\text{-}13)$$

where j = 1 or 2.

While Eq. 4-13 may look imposing, it offers a very simple representation for $\lambda_{K_{eff}}$ given λ_{K_i} and λ_{K_2}:

$$\lambda_{K_1} K_1 + \lambda_{K_2} K_2 = e(K_{eff}/e)^{\beta+1} \; (\gamma_1 K_1^{-\beta} + \gamma_2^{-\beta}) \lambda_{K_{eff}}$$

$$= K_{eff} \lambda_{K_{eff}}$$

or,

$$\lambda_{K_{eff}} = \frac{\lambda_1 K_1 + \lambda_2 K_2}{K_{eff}} \qquad (4\text{-}14)$$

Equation 4-14 states that the effective rental value of the capital combination is equal to the total spent on both divided by the effective level of capital. This property follows directly from the homogeneity of the translog production function.

The model calculates the γ and g parameters for the effective capital function in a way similar to Secs. 4.2.1 and 4.2.2. Equation 4-5 gives the λ_{K_j} for the current economy. By replacing K_i with K_1, L_i with K_2, λ_{K_i} with λ_{K_1} and λ_L with λ_{K_2}, Eqs. 4-6 allow the calculation of γ_{K_1} and γ_{K_2}. Similarly, replacing X_i^p with $K_1 + K_2$, and β_i with β, Eq. 4-7 allows the calculation of g.

5.0 EQUILIBRIUM ECONOMY

The equilibrium economy is defined as that economy where capital is being produced at such a rate that capital per unit population remains constant. Furthermore, real prices must remain constant. For these reasons, the equilibrium economy is not necessarily the current economy, although it could be if no industry is experiencing a growth greater than population growth and there are no consumer preference changes. The equilibrium economy is calculated in subroutine EQLBRM. The logical flow of EQLBRM is diagrammed in Fig. 5-1.

5.1 CAPITAL INVENTORY LEVELS AND INVESTMENT

Capital must increase with the population to provide the same level of production per person. Assuming an exponential growth in population, P, and a depreciation rate, d, the capital inventory at time t, K(t), is related to the inventory at time t_o by:

$$K(t) = K(t_o)\, e^{P(t-t_o)} \tag{5-1a}$$

and

$$K(t) = K(t_o)\, e^{-d(t-t_o)} + \int_{t_o}^{t} X^I(t' - \tau)\, e^{-d(t-t')}\, dt' \tag{5-1b}$$

where τ = gestation time

$X^I(t' - \tau)$ = amount of new capital becoming available at t'

Note that Eq. 5-1b is a statement of physical fact. Inventory at time t must be equal to the inventory at time t_o which has not depreciated, plus what has been made between t_o and t. Eq. 5-1a, on the other hand, is valid only in equilibrium. It states that capital inventory increases at the same rate as population.

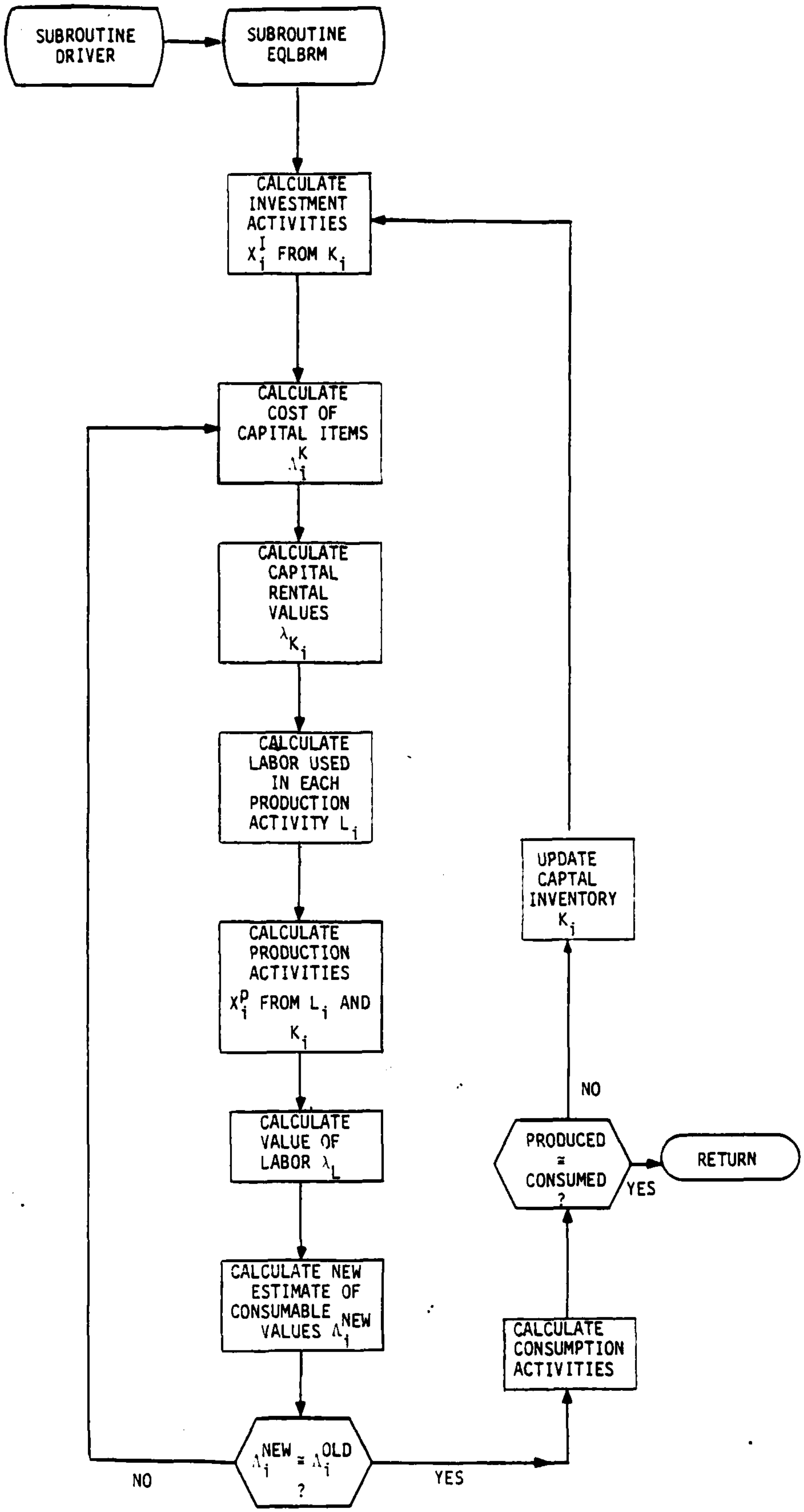


Figure 5-1. Logic Flow of Equilibrium Calculation

Setting the right hand sides of Eqs. 5-1 equal to each other and differentiating with respect to t yields the expression:

$$K(t_o) \left[P\, e^{P(t-t_o)} + d\, e^{-d(t-t_o)} \right] =$$

$$X^I(t - \tau) - d \int_{t_o}^{t} X^I(t' - \tau)\, e^{-d(t-t')}\, dt' \qquad (5\text{-}2)$$

The integral in Eq. 5-2 may be related to K(t) and $K(t_o)$ from Eq. 5-1 to finally yield:

$$K(t_o)(P + d)\, e^{P(t-t_o)} = X^I(t - \tau)$$

$$(5\text{-}3)$$

or $$K(t_o)(P + d)\, e^{P(t-t_o)}\, e^{P\tau} = X^I(t)$$

which, through Eq. 5-1a becomes

$$K(t)(P + d)\, e^{P\tau} = X^I(t) \qquad (5\text{-}4)$$

Equation 5-4 relates the activity level in equilibrium to the inventory level. The inventory level will grow in time at the same rate as population. It is convenient in the model and clearer to the user to normalize inventory and activity level to the current day population so that the time dependence in Eq. 5-4 may be removed. After all, there is no way to know before the model is run how long it will take to reach equilibrium, and a curve (trajectory) which flattens at equilibrium is much easier to interpret than one which grows exponentially at the population growth rate. With this normalization, Eqs. 5-1 become:

$$K(t) = K(t_o) \qquad (5\text{-}5a)$$

$$K(t) = K(t_o)\, e^{-(P+d)(t-t_o)} + e^{-P\tau} \int_{to}^{t} X^I(t' - \tau)\, e^{-(P+D)(t-t')}\, dt' \qquad (5\text{-}5b)$$

where K is normalized to population and is not the same as the K of Eqs. 5-1. The end result of solving Eq. 5-5 for X^I as a function of K is identical to Eq. 5-4 with the time dependence removed:

$$X^I_{\text{Equilibrium}} = K_{\text{Equilibrium}}(P + d)e^{P\tau} \qquad (5\text{-}6)$$

5.2 CAPITAL RENTAL VALUES

In equilibrium, the rental value for capital is related to its cost of production in a very simple way. Since the cost of production must be equal to the sum over time of all the discounted rents, and since in equilibrium the rental value must remain constant, Eq. 7-10 (See Sec. 7) reduces to:

$$\Lambda_{\text{Equilibrium}} = \lambda_{\text{Equilibrium}} \frac{e^{-(P+\rho)\tau}}{P + d + \rho} \qquad (5\text{-}7)$$

where Λ = cost of production

λ = rental value per unit time

ρ = discount rate

5.3 FINDING THE EQUILIBRIUM STATE

The following is the algorithm used by the model to calculate the equilibrium state (see Fig. 5-1). It is an iterative technique which converges rapidly. If the current economy contains no growth relative to population growth, i.e., is itself an equilibrium, and if the utility parameters have not changed, the process clearly takes one iteration. If the above is not true, the process may take ten to twenty iterations.

The reader should note that by this time the parameters γ, β, Γ, b, and α have been calculated from the current economy and are fixed hereon and available to the model.

1. Assume some set Λ_i of consumable values and some set K_i of capital resources, e.g., the current economy values.

2. Calculate the investment activities X_i^I from Eq. 5-6.

3. Find the cost of capital, Λ_i^I, from the consumable values Λ_i.

4. Calculate the rental value λ_{K_i}, from Λ_i^I and Eq. 5-7.

5. Calculate the labor required for each production activity from Eq. 2-10a:

$$L_i = K_i \frac{\gamma_{L_i}}{\left(\dfrac{\lambda_{K_i}}{e_i \gamma_{K_i} \Lambda_i'}\right)^{-\beta_i/(1+\beta_i)} - \gamma_{K_i}} \tag{5-8}$$

where $\Lambda_i' = \Lambda_i - \sum_j \alpha_{ij} \Lambda_j$

and α_{ij} = amount of consumable j required per unit activity i.

6. From L_i and K_i calculate the production activities X_i^P from the translog function, Eq. 2-4:

$$X_i^P = e_i \left[\gamma_{K_i} K_i^{-\beta_i} + \gamma_{L_i} L_i^{-\beta_i}\right]^{-1/\beta_i} \tag{5-9}$$

7. Find λ_L from the utility function for leisure:

$$\lambda_L = \frac{\Gamma_{Leisure}}{(L - \sum_i L_i)^{b_{Leisure}}} \tag{5-10}$$

8. Find a new estimate for Λ_i from Eq. 2-6:

$$\Lambda_i^{Calculated} = \frac{\lambda_{K_i} K_i + \lambda_L L_i + \sum_{j \neq i} X_i^P \alpha_{ij} \Lambda_j}{(1 - \alpha_{ii}) X_i^P} \tag{5-11}$$

$$\Lambda_i^{New} = \tfrac{1}{2} (\Lambda_i^{Calculated} + \Lambda_i) \tag{5-11b}$$

9. If $\Lambda_i^{New} \simeq \Lambda_i$, proceed. Otherwise go back to Step 3.

10. Next find the cost per unit consumption activity and the level of that activity:

$$\Lambda_i^c = \sum_j \alpha_{ij} \Lambda_j . \tag{5-12a}$$

$$X_i^c = \left(\Gamma_i / \Lambda_i^c\right)^{1/b_i} \tag{5-12b}$$

11. Compare how much of each commodity was produced, x_i^P, with how much was used, $x_i^{Used} = \sum_{\text{all activities } j} X_j \alpha_{ji}$, and form a new estimate of the $\{K_i\}$:

$$K_i^{New} = K_i^{Old} \frac{2X_i^{Used}}{X_i^{Used} + X_i^P} \qquad (5\text{-}13)$$

If $K_i^{New} \simeq K_i^{Old}$, the equilibrium is known. If not, go back to Step 2.

6.0 SINGLE TIME PERIOD OPTIMIZER

The single time period optimizer (subroutine ACTVTY in the model) optimizes the level of production and consumption activities, calculates the rental values for capital, and calculates the level of investment (production of capital). Inputs include capital inventory available for the production activities, capital value from the future (Phase 1) or investment activities (Phase 2), depreciation rates for capital, translog parameters (see Assumption 2 of Sec. 2), minimum consumption activity levels, and the direct requirements matrix. Outputs include the rental values for capital and labor, the activity levels, and the consumable values. The logic flow of subroutine ACTVTY is diagrammed in Fig. 6-6.

6.1 PRODUCTION ACTIVITIES

Each consumable i is produced by a separate activity using capital K_i, labor L_i, and a specified fraction α_{ij} of each of the N consumables per unit activity. If more than one type of capital is used, K_i refers to the "effective" capital produced by the combination (see Sec. 4.2.4).

The capital used in the production of consumable i is the entire inventory of capital available. Obviously one cannot use more capital than available, and using less would cause its value to drop to zero relative to labor. Therefore, from the translog function,

$$X_i^p = g_i \left[\gamma_{K_i} K_i^{-\beta_i} + \gamma_{L_i} L_i^{-\beta_i} \right]^{-1/\beta_i} \tag{6-1}$$

the level of production activity is dependent on labor alone. But how much labor should be applied? Section 2 answered that question through Eq. 2-10:

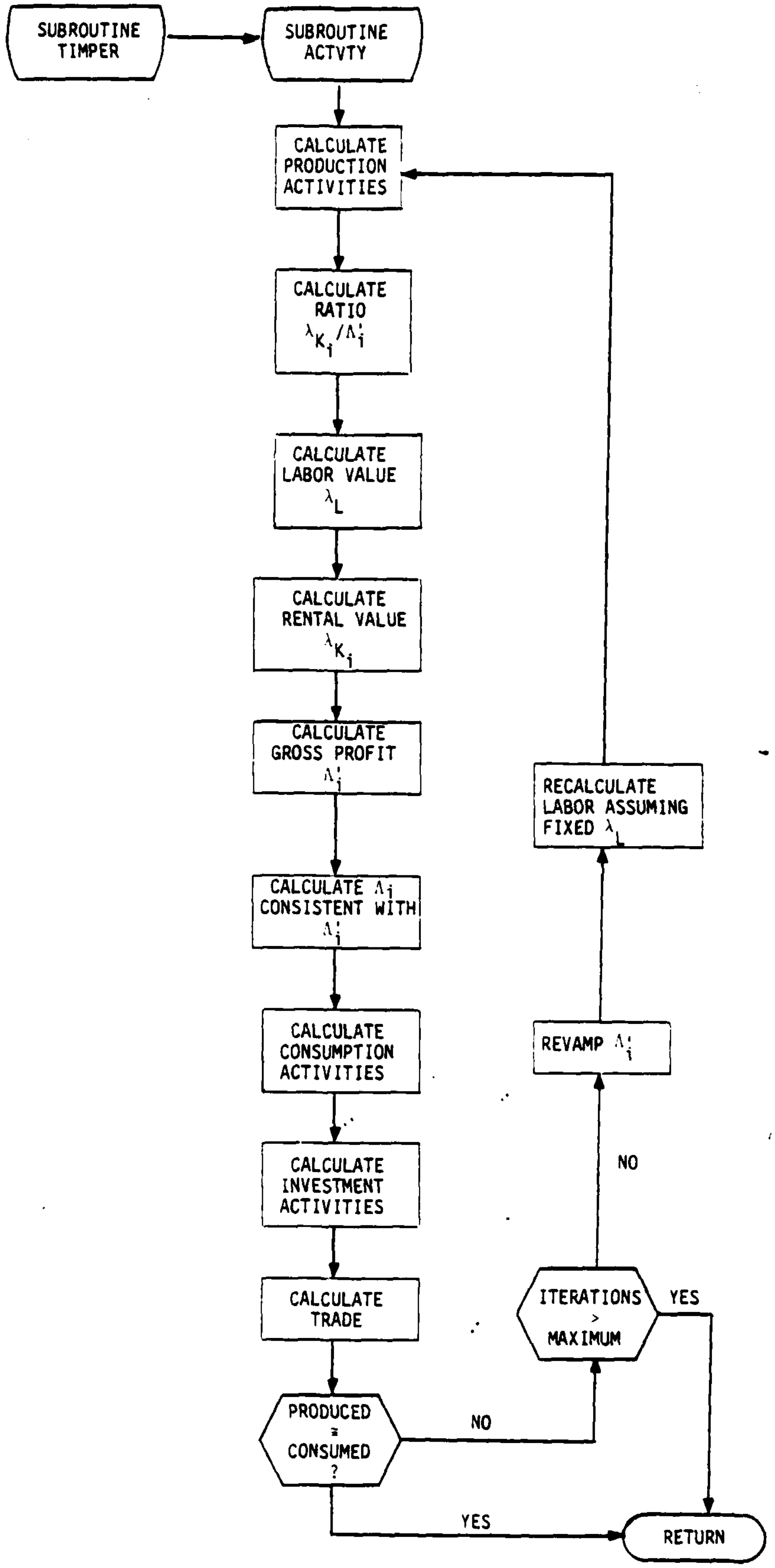


Figure 6-1. Logic Flow of Single Time Period Optimizer

$$L_i = K_i \left[\frac{\gamma_{L_i}}{\left(\dfrac{\lambda_{K_i}}{g_i \gamma_{K_i} \Lambda'_i}\right)^{-\beta_i/(1+\beta_i)} - \gamma_{K_i}} \right]^{1/\beta_i} \tag{6-2}$$

where the parameters were described in Sec. 2. The important variables in Eq. 6-2 are the Λ'_i, the gross profit from producing consumable i which is available for renting the capital and labor used to produce it:

$$\Lambda'_i \equiv \Lambda_i - \sum_j \alpha_{ij}\Lambda_j$$

By combining Eqs. 6-1 and 6-2, Λ'_i may be related directly to the activity level X_i^p:

$$\left(\frac{X_i^p}{g_i}\right) = \left(\frac{\lambda_{K_i}}{g_i \gamma_K \Lambda'_i}\right)^{1/\beta_i+1} K_i \tag{6-3}$$

Equations 6-1 through 6-3 are the crux of the single time period optimization. The process starts as follows:

1. Assume some level of labor, L_i, for each production activity. This labor is usually the labor required to produce the same level of activity as achieved for this consumable and time period last pass.
2. From L_i calculate X_i^p from Eq. 6-1.

3. From X_i^p calculate the ratio $\lambda_{K_i}/(e_i\gamma_K\Lambda_i')$ for each consumable from Eq. 6-3.

4. Sum each L_i to find the total labor used and calculate λ_L from the resulting consumption of leisure:

$$\lambda_L = \frac{\Gamma_{\text{Leisure}}}{\left(L - \sum_i L_i\right)^{b_{\text{Leisure}}}} \tag{6-4}$$

5. Find λ_{K_i} from Eq. 2-8:

$$\left(\frac{K_i}{L_i}\right)^{\beta_i+1} = \frac{\gamma_{K_i}\lambda_L}{\gamma_{L_i}\lambda_{K_i}} \tag{6-5}$$

6. From the ratio found in step 3 and λ_{K_i}, calculate the Λ_i'.

At this point the set $\{\Lambda_i'\}$ is known, but the individual Λ_i are not. However, through the definition of the Λ_i' in matrix notation,

$$\Lambda' = (I - \alpha)\Lambda$$

the $\{\Lambda_i\}$ may be found by inverting the matrix $(I - \alpha)$. From the Λ_i the consumption activities may be calculated.

6.2 CONSUMPTION ACTIVITIES

Once the Λ_i are known, the cost per unit of consumption activity i may be calculated. If the consumption activity i uses α_{ij} of consumable j, then the cost per unit of activity is:

$$C_i = \sum_j \alpha_{ij}\Lambda_j \tag{6-7}$$

The activity level is determined by Eq. 2-2:

$$x_i^c = \left(\frac{\Gamma_i}{C_i}\right)^{1/b_i} \tag{6-8}$$

6.3 INVESTMENT ACTIVITIES

Investment activities are calculated in one of two ways depending on whether the program has just started or is trying to refine its trajectory.

6.3.1 Phase One

In phase one of the program, the level of investment activities is found by comparing the cost of producing capital with its expected worth to the future. Assuming the program has completed at least one pass, there exists a time stream of rental values for the various capital. These may be propagated backwards in time, accounting for discount rates, depreciation, etc., as described in Section 7.2, to yield a value for capital to each time period. The cost of producing the capital, which uses only consumables in its production, may be found in a way identical to Eq. 6-7.

The problem arises, however, that if the particular time period has a cost of production greater or less than the worth of the capital, it will want to produce zero or infinite amounts of the capital. This problem is essentially solved by assuming the value of the capital is correct only if the given time period makes capital in reasonable quantities. Less production increases the future value of the capital, and more production reduces the future value of the capital. The functional nature of this process is described in terms of two parameters, R_{TGT} and R_{FUT}. R_{FUT} is the capital resource level one gestation time in the future if <u>nothing</u> is produced. R_{TGT} is the target resource level, i.e., it is the level of inventory which existed one gestation time in the

future during the last pass. The difference, $R_{TGT} - R_{FUT}$, is what should be produced this time period assuming cost equals value.[1]

Once R_{FUT} and R_{TGT} are known, X_i^I is found through the equation:

$$X_i^I = \frac{R_{TGT} - R_{FUT} + s_i \ln (\Lambda_i/C_i^I)}{\Delta t} \tag{6-9}$$

where Λ_i is the value of the capital propagated from the future, and s_i is a scale factor essentially equal to the equilibrium activity level X_{iEQ}^I. The effect of Eq. 6-9 is to produce negative feedback. If the investment activity is too small, rental values will be high in the future causing Λ_i to be large next pass, causing the time period to produce more than it did last pass. This in turn causes the inventory in the future to rise and rental values to fall, lowering Λ_i^I for the next pass.

While this process sounds as if it should cause swift convergence, it in fact causes too much feedback, resulting in an oscillatory state wherein every other pass results in too little investment followed by too much investment. This effect is cured by averaging inventories from pass to pass until a pseudo-stable trajectory arises, and then proceeding into phase two.

For the first pass of the program R_{TGT} is defined as the equilibrium resource level while Λ_i^I is the equilibrium capital value. These values cause the model to invest to such a degree that, while not producing an optimal trajectory, it at least produces one which brings the economy to equilibrium.

---

[1] In reality, more needs to be produced because of depreciation. Therefore the model uses $R'_{FUT} \equiv R_{GUT}(1 - \Delta t/F) + R_{FUT}(\Delta t/F)$, where $F = e^{-P\tau} (1 - e^{-(P+d)\Delta t})/(P+d)$ (See Sec. 7.1).

6.3.2 Phase Two

In phase two the investment trajectory is approximately known. At this stage the single time period optimizer accepts the investment activities as given, regardless of the cost of production or the future value of the capital. These activities are adjusted up or down external to the single time period optimizer through the use of an Everett type algorithm.

This algorithm operates in the following way. Consider a single activity X_i^I. On the previous pass the activity had a cost of production equal to C_i^I. After the rental values have been propagated back in time a value Λ_i results. For the next pass X_i^I is reset by:

$$X_i^I = X_i^I(1 + \varepsilon), \quad C_i^I < \Lambda_i \tag{6-10}$$

or $$X_i^I = X_i^I(1 - \varepsilon), \quad \bar{C}_i^I > \Lambda_i.$$

The parameter ε is reset each time by

$$\varepsilon = \varepsilon(1 + \delta F), \text{ for } S = +1$$

or $$\varepsilon = \varepsilon(1 - \delta), \quad \text{for } S = -1 \tag{6-11}$$

where S is defined as the direction of change, i.e, $S = +1$ if $C_i^I > \Lambda_i^I$ botn this pass <u>and</u> last pass or $C_i^I < \Lambda_i^I$ both this pass <u>and</u> last pass. $S = -1$ if $C_i^I > \Lambda_i^I$ for one of the two passes and $C_i^I < \Lambda_i^I$ for the other. The parameters δ and F are constants. In the model they are set to 0.6 and 0.5 respectively. This algorithm very quickly and efficiently narrows the investment trajectory to the optimum. Inventories are <u>not</u> averaged during phase two.

6.4 TRADE

The current ACDA version of DYNEVAL does not model trade explicitly. Some mechanism is needed, however, to account for the "undifferentiated imports" required in some production and investment activities. This is handled by summing all activities to determine the amount of undifferentiated imports required, and setting the trade activity at the proper level. All other commodities are imported or exported at this level according to the proportions in which they are imported or exported in the current economy.

6.5 CONVERGENCE

Once the production, consumption, trade and investment activities are known, a comparison may be made between the amount of a given consumable which is produced and the amount which is used or consumed. These two values should be equal. In general, however, they will not be, and a scheme must be developed to bring them together. This is accomplished by using once again an Everett type of algorithm on the Λ_i' [1] of each consumable. When production exceeds consumption Λ_i' is reduced and when consumption exceed production Λ_i' is increased.

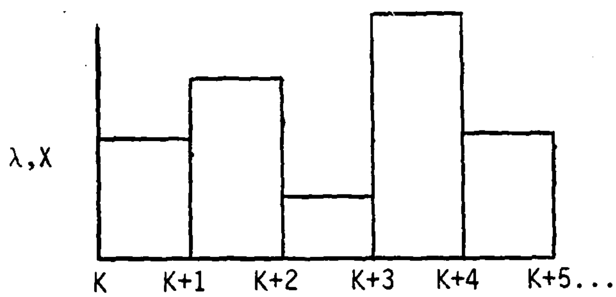
When Λ_i^I is changed, all other variables will also change. One parameter, however, is less sensitive than most. This is the rental value of labor. Using Eq. 2-10b with the new value of Λ_i' and the old value of λ_L provides a new estimate for L_i. One may then proceed as discussed in 6.1 above.

[1]It is important that the Everett algorithm be applied to the Λ_i' and not the individual Λ_i. Doing the latter results in wild swings in the production activities since Λ_i' can easily become negative resulting in zero production. A higher Λ_i' must result in increased production. A higher Λ_i need not do so if the other Λ_i increase as well.

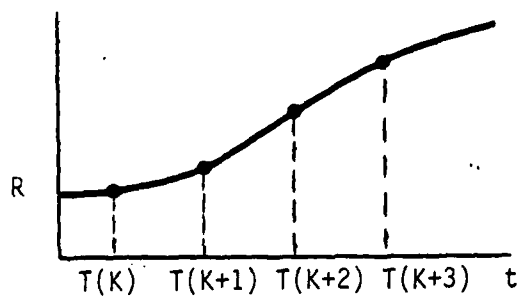
This process usually converges quickly and efficiently. When there has been a large destruction of capital, however, the early time periods may have trouble converging. This occurs because one or more industries is working near capacity and yet its Λ_i' keeps getting signals to increase. The industry cannot increase its output so costs, including labor costs, increase until consumers cannot purchase anything and the system reverses itself. To prevent the model from spending too much of its time on a problem which will be changed anyway after the future sends its information back through time, a limit of 20 iterations is imposed on the single time period optimizer.

7.0 PROPAGATION THROUGH TIME OF CAPITAL AND VALUE

Figure 7-1 illustrates the temporal structure of the model. Each time period K is of equal length, Δt. The array, T(K), stores the time at the middle of time period K, [i.e., $T(K) = (K - 1)\Delta t + \Delta t/2$]. $T_0(K)$ is the time at the start of time period K. The activities, X, and the shadow (rental) values, λ, are represented as constant rates within time period K:



Resource inventories are considered continuous in time, with the values at T(K) stored in array R(K):[1]



[1] In this section capital resources will be designated as R to conform to the model representation and to avoid confusion with the time index K.

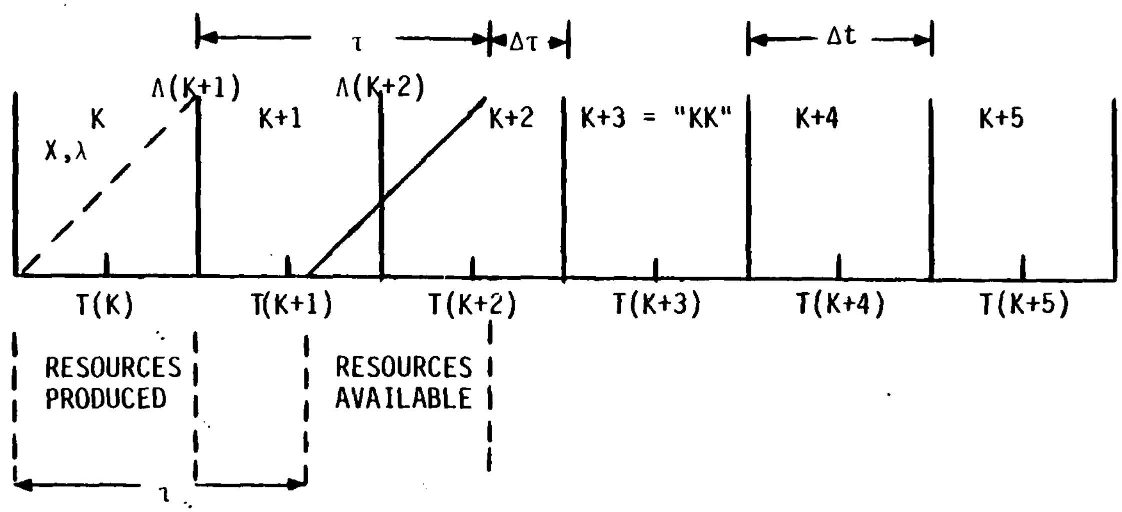
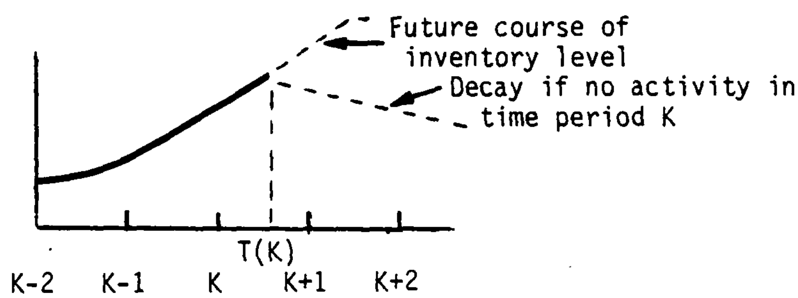


Figure 7-1. Temporal Structure of the Model

The shadow value $\Lambda(K + 1)$ represents the worth of the resource which time period K passes to the future measured in present day value. It does not represent the worth to time period K + 1. Rather, Λ is used by time period K in determining the amount it should produce, and so reflects the discounted future stream of λ's encountered after the gestation time τ.

The resource level at the center of time period K, $R_i(K)$, is the inventory available to time period K. Strictly speaking, an integrated average of R_i would be a better approximation. However, for gestation times τ less than Δt the averaging would be incorrect anyway. For example, if $\tau = \frac{1}{2}\Delta t$, the following picture arises:



At the beginning of time period K, the activity level X(K) has not been determined, and the resource level at the end of time period K reflects the natural depreciation of the resource. In this example, using R(K) is obviously a better estimate of the available resources than an actual integration of the curve would yield.

7.1 RESOURCE PROPAGATION

After the X_i^I [1] are determined, the resources produced are propagated through time. This occurs in subroutine TIMPER. As resources propagate,

[1] $X_i^I(K)$ here refers to the rate of production of resource R_i during the Kth time period in units of resource/unit time.

they depreciate with a natural depreciation rate d. Furthermore, resources are normalized to population so as the population grows at a rate P, resource inventories are reduced. As the resource propagates, each value of $R(K' \geq K)$ is increased by an amount $\Delta R(K')$, where $\Delta R(K')$ is determined in the following way.

Resources begin to come on line at time $T_{start} = T_0(K) + \tau$ $= T(K) - \frac{\Delta t}{2} + \tau$. For time t _ T_{start}, $\Delta R = 0$. No resource is yet available due to the gestation time τ. Therefore, for K' such that $T(K') \leq T_{start}$,

$$\Delta R(K') = 0 \tag{7-1}$$

Resources finish coming on line at time $T_{stop} = T_0(K + 1) + \tau$ $= T(K + 1) - \frac{\Delta t}{2} + \tau$. For time t between T_{start} and T_{stop}, ΔR reflects the incoming resources which have come on line by time t. Therefore, for K' such that

$$T_{start} \leq T(K') \leq T_{stop},$$

$$\Delta R(K') = X^I(K')e^{-P\tau} \int_0^{T(K')-T_{start}} e^{-(P+d)t}\, dt$$

$$= X^I(K')\, e^{-P\tau}\, \frac{1 - e^{-(P+d)[T(K')-T_{start}]}}{P + d} \tag{7-2}$$

where $\quad d$ = depreciation rate

$\qquad P$ = population growth rate

[1] $X_i^I(K)$ here refers to the rate of production of resource R_i during the Kth time period in units of resource/unit time.

For time $t \geq T_{stop}$, ΔR reflects the depreciated value of all the resources produced in time period K:

$$\Delta R(K\ ) = \underbrace{X(K)\ e^{-P}}_{\substack{\text{population}\\ \text{growth during}\\ \text{gestation}}}\ \underbrace{\frac{1 - e^{-(P+d)\Delta t}}{P + d}}_{\substack{\text{depreciation between}\\ \text{time coming available}\\ \text{and time when all}\\ \text{units come on line}}}\ \underbrace{e^{-(P+d)[T(K')-T_{stop}]}}_{\substack{\text{depreciation}\\ \text{after all units}\\ \text{are on line}}} \qquad (7\text{-}3)$$

Equations 7-1 through 7-3 may be combined as follows:

For all $\quad K' \geq K$

$$\Delta R(K') = X(K)\ e^{-P\tau} \left[\frac{1.0 - \exp\left(-(P + d) \cdot \text{AMIN1}\left\{\Delta t, \text{AMAX1}[0.0,\ t(K') - T_{start}]\right\}\right)}{P + d} \right]$$

$$\exp\left\{-(P + d) \cdot \text{AMAX1}[0.0,\ T(K') - T_{stop}]\right\} \qquad (7\text{-}4)$$

Note that for $\tau < \frac{\Delta t}{2}$, $\Delta R(K) \neq 0$. This is allowed for all time periods except K = 1, since by definition R(1) is the starting resource and if it is allowed to increase, the next pass of the model will in effect be solving a different problem with a higher starting resource. Therefore, the length of each time period must be such that $\Delta t \leq 2\tau$. The smaller Δt is, the longer each pass of the model takes since more time periods are required, but, in general fewer passes are required due to increased accuracy.

7.2 VALUE PROPAGATION

This section describes how the $\Lambda(K + 1)$ are derived for the next pass. After a complete pass, subroutine LAMBAC propagates the rental values λ back in time to define a future worth, $\Lambda(K + 1)$, to time period K for its capital. Since it is assumed that the activity level $X^I(K)$ is constant throughout the time period and that the decision

maker decides this level at the beginning of the time period, the basic equation for $\Lambda(K+1)$ is:

$$\Lambda(K + 1)X^I(K)\Delta t' = \sum_{\text{future}} \text{discounted rents on amount produced} \tag{7-5}$$

The value $\Delta t'$ represents the fact that the value $\Lambda(K + 1)$ is also discounted through the time period, i.e.,

$$\Delta t' = \frac{1.0 - e^{-\rho \Delta t}}{\rho}$$

where ρ is the discount rate. Throughout this discussion it will be assumed that Fig. 7-1 applies. The index KK in Fig. 7-1 refers to the first index after K such that gestation is completed:

$$KK = \mathrm{INT}\left[\frac{T(K + 1) + \tau}{\Delta t} + 1.5\right]$$

In the (KK-2)th time period, resources start to come on line and continue (in this time period) for a time $\Delta\tau$ (see Fig. 7-1). Therefore, the first component of $\Lambda(K + 1)$ is:

$$\Lambda^1(K + 1)X^I(K)\Delta t' = \underbrace{\lambda(KK - 2)}_{\text{rental value}}\underbrace{e^{-(P+\rho)\tau}}_{\substack{\text{discount and}\\ \text{population growth}\\ \text{during gestation}}}\int_0^{\Delta\tau} \underbrace{X^I(K)\,\frac{1 - e^{-(P+d)t}}{P + d}}_{\substack{\text{amount available}\\ \text{between } \tau \geq t \geq \tau+\Delta\tau}}\underbrace{e^{-\rho t}}_{\substack{\text{discount}\\ \text{beyond}\\ \text{gestation time}}}\,dt$$

$$= \lambda(KK - 2)\, e^{-(P+\rho)\tau}\, X^I(K)\left[\frac{e^{-(P+d+\rho)\Delta\tau} - 1}{P + d + \rho} - \frac{e^{-\rho\Delta\tau} - 1}{\rho}\right] \tag{7-6}$$

In the (KK-1)th time period, resources continue to come on line for a time at $\Delta t - \Delta\tau$. They all then depreciate for the rest of the time period $\Delta\tau$. Thus:

$$\Lambda^2(K+1)X^I(K)\Delta t' = \lambda(KK-1)\, e^{-(P+\rho)\tau}\, X^I(K)$$

$$\cdot \int_{\Delta\tau}^{\Delta t}\left[\frac{1-e^{-(P+d)t}}{P+d}\right] e^{-\rho t}\, dt$$

$$+ \left[\frac{1-e^{-(P+d)\Delta t}}{P+d}\right] e^{-\rho\Delta t} \cdot \left[\int_0^{\Delta\tau} e^{-(P+d+\rho)t}\, dt\right]$$

$$= \frac{\lambda(KK-1)\, e^{-(P+\rho)\tau}\, X^I(K)}{P+d}\left[\frac{e^{-(P+d+\rho)\Delta t} - e^{-(P+d+\rho)\Delta\tau}}{P+d+\rho}\right.$$

$$\left. + \frac{e^{-\rho\Delta\tau} - e^{-\rho\Delta t}}{\rho} + \frac{\left[e^{-\rho\Delta t} - e^{-(P+d+\rho)\Delta t}\right]\left[1 - e^{-(P+d+\rho)\Delta\tau}\right]}{P+d+\rho}\right] \quad (7\text{-}7)$$

For the rest of time, the resources continue to depreciate:

$$\Lambda^3(K+1)X^I(K)\Delta t' = e^{-(P+\rho)\tau} X^I(K) \sum_{k=0}^{\infty} \lambda(KK+k)\, e^{-\rho\Delta t}\, \frac{\left[1 - e^{-(P+d)\Delta t}\right]}{P+d}$$

$$\cdot\, e^{-(P+d+\rho)\,(\Delta\tau + k\Delta\ )}\left[\frac{1 - e^{-(P+d+\rho)\Delta t}}{P+d+\rho}\right] \quad (7\text{-}8)$$

Similar expressions may be derived for $\Lambda(K + 2)$. If this is done it is seen that $\Lambda(K + 1)$ may be related to $\Lambda(K + 2)$ and the three rental values, $\lambda(KK - 2)$, $\lambda(KK - 1)$, and $\lambda(KK)$:

$$\Lambda(K + 1) = \lambda(K + 2)\, e^{-(P+d+\rho)\Delta t}$$

$$+ \frac{e^{-(P+\rho)\tau}}{(P + d)\Delta t'} \left(\lambda(KK - 2) \left[\frac{1 - e^{-\rho\Delta\tau}}{\rho} - \frac{1 - e^{-(P+d+\rho)\Delta\tau}}{P + d + \rho} \right] \right.$$

$$+ \lambda(KK - 1) \left\{ \frac{e^{-\rho\Delta\tau} \left[1 + e^{-(P+d+\rho)\Delta t}\right] - e^{-(P+d+\rho)\Delta t} - e^{-\rho\Delta t}}{\rho} \right.$$

$$\left. + \frac{e^{-\rho\Delta t}\left[1 - e^{-(P+d+\rho)\Delta\tau}\right] + \left[e^{-(P+d+\rho)\Delta t} - e^{-(P+d+\rho)\Delta\tau}\right]}{P + d + \rho} \right\}$$

$$+ \lambda(KK) \left\{ \frac{e^{-\rho\Delta t} \left[e^{-(P+d+\rho)\Delta\tau} - e^{-(P+d+\rho)\Delta t}\right]}{P + d + \rho} \right.$$

$$\left.\left. + e^{-(P+d+\rho)\Delta t} \frac{\left(e^{-\rho\Delta t} - e^{-\rho\Delta\tau}\right)}{\rho} \right\} \right) \qquad (7\text{-}9)$$

Equation 7-9 is used by the model in subroutine LAMBAC to derive the shadow values $\Lambda(K + 1)$ used in the next pass. Note that at equilibrium $\Lambda(K + 1) = \Lambda(K + 2)$ and $\lambda(KK - 2) = \lambda(KK - 1) = \lambda(KK)$. In this case, Eq. 7-9 reduces to:

$$\Lambda = \frac{\lambda\, e^{-(P+d+\rho)\tau}}{P + d + \rho} \qquad (7\text{-}10)$$

which is the equilibrium value used in Sec. 5.1.

APPENDIX A

USER'S MANUAL

A.1 INTRODUCTION

This appendix explains how to use the Dynamic Economic Values Model (DYNEVAL). It is assumed that a data file exists containing the primary data describing the current economy. This file is most easily created through the use of the data aggregator AGGRAT which aggregates DSA format economic data into economic sectors specified by the user and puts the aggregated data onto a file in a form accepted by the model. AGGRAT is described in Appendix B.

Besides the data describing the current economy, which includes depreciation rates, gestation times for capital formation, etc., specific variables describing the disruption or change to the economy are needed. These variables are unique to each study and need to be entered when the model is run. The following is a step by step description of how these variables are entered, what options are available to the user, and what the final output of the model (terminal and line printer) looks like. A sample listing of line printer output is given in Sec. A.5.

A.2 START-UP

Upon initiating execution of DYNEVAL, the following question is asked:

IS THIS A RESTART?

The model has a restart capability which allows the user to stop the model and restart it where it left off with changes in print and plot switches (see Sec. A.3). The restart capability is especially useful when peculiarities in the summary outputs are noticed and the user wants to get detailed prints or plots of the next couple of passes. This question, like all yes/no questions, may be answered with YES(NO) or simply Y(N).

DYNEVAL next asks:

FULL PRINT OF EACH PASS (Y) OR
SUMMARY ONLY (N)

This question refers to line printer output. The model calculates the optimal economic trajectory through an iterative technique. A summary of each pass is printed on both the terminal and the line printer (see Sec. D). If the user answers this question with YES, however, a time period by time period listing of important parameters is also printed on the line printer. A description of this output is given in Sec. A.4.

Besides numerical output, the model is also capable of graphical summaries. The next question asked by DYNEVAL is:

IS OUTPUT FOR PLOTS DESIRED? (YES, NO, OR END).

A YES or END answer opens (creates) a plotting file and sets the plot switch. If the user wants to see how selected variables change from pass to pass or wants to make graphs at various stages of convergence, he should answer with YES. If the user does not care about the convergence process but would like time period plots of the final economic trajectories, he should answer END. It should be noted that if the plot option is selected the model merely outputs relevant data onto a file. A separate program is required to convert the data into plots. Such a program (PLOTER) has been written using the Tektronix software, PLOT-10. Should a different software package (e.g., DEC's DSSPLA) be desired, a new program will have to be designed.

Once the output of the model has been determined, DYNEVAL queries the user concerning the parameters for the study. The first data asked for is:

INPUT PASS LIMIT AND STOPPING CRITERION

The model will continue its operation until either convergence is achieved or it has completed a maximum number of passes. The pass limit is the maximum number of passes the user wants the model to complete. A value of 50-100 is normally sufficient. The stopping criterion is the value of FOM2, the second figure-of-merit printed in the summary of each pass, which indicates that convergence is satisfactory. The various figures-of-merit are discussed in Sec. A.3. A value of 0.01-0.05 for the stopping criterion is usually sufficient.

If this is a restart, the program proceeds where it left off. Otherwise, DYNEVAL next asks for the extent of the run:

INPUT NUMBER OF TIME PERIODS DESIRED

The number of time periods times the length of each time period should be large enough so that the economy has time to reach its equilibrium state. Forty to fifty years is sufficient for most studies. After the number of time periods has been input, the model is able to calculate the total storage requirement for the study. It informs the user how much storage he is using and how much is available:

STORAGE USED = 8732, STORAGE AVAILABLE = 20,000

If too much storage is required, the following message will be printed on the terminal:

INCREASE DIMENSION OF ARRAY W IN MAIN PROGRAM TO AT LEAST (amount required) -- PROGRAM ABORTED

The user will have to increase the dimension of array W and change the value of parameter NW in the main program and recompile. Ample storage is allowed for most studies.

Assuming the storage requirement is smaller than the available storage, DYNEVAL next asks for the length of each time period:

INPUT LENGTH OF TIME PERIOD (YEARS)

For a given length of time over which the model optimizes, greater accuracy with fewer passes is achieved with many time periods of short duration. More data storage and longer time per pass is also required, however, so the user needs to trade off the costs and benefits of the division. In no case may the time period length be greater than twice the smallest gestation time. If this occurs, DYNEVAL will warn the user:

TIME PERIOD LENGTH MAY NOT BE GREATER THAN (NO. OF YEARS),
I.E., 2.* MINIMUM GESTATION TIME OF (SMALLEST GESTATION TIME) INPUT LENGTH OF TIME PERIOD (YEARS)

The model next asks the user about the basic parameters of the study. It remembers the parameters used for the last study, but the user may change any he wishes. If the user would like to see the current values of the basic parameters he may either answer YES to the following:

WOULD YOU LIKE BASIC PARAMETER ARRAYS
PRINTED ON LP? (Y or N),

which will output the basic arrays to the line printer, or, if this question is answered with NO, he may have specific arrays displayed on the terminal by answering YES to:

WOULD YOU LIKE ANY OF THE BASIC PARAMETER ARRAYS
DISPLAYED? (Y or N)

Assuming the user answers YES, DYNEVAL answers with:

INPUT ARRAY NAME

TYPE 'M' TO DISPLAY MENU

Entering an M on the terminal shows the user what the "basic parameter arrays" are and how to access them.

```
MENU:        Z = MINIMUM CONSUMPTION ACTIVITY

             B = UTILITY EXPONENT FOR CONSUMPTION ACTIVITY

             G = RATIO OF POST-ATTACK UTILITY COEFFICIENTS TO TODAY'S
                 UTILITY COEFFICIENTS

          BETA = TRANSLOG EXPONENT FOR CAPITAL/LABOR TRADE-OFFS
                 (IF .LT. -1.0, BETA IS CALCULATED TO GIVE THE
                 LIMITING PRODUCTIVITY A VALUE OF ABS (INPUT
                 VALUE) (See Sec. 4.2.3)

          BET2 = TRANSLOG EXPONENT FOR CAPITAL/CAPITAL TRADE-OFFS
                 (ONLY FOR THOSE PRODUCTION ACTIVITIES USING
                 2 TYPES OF CAPITAL)

             F = FRACTION OF CAPITAL SURVIVING

             M = REDISPLAY MENU

             E = END OF REQUESTS

INPUT ARRAY NAME

TYPE 'M' TO DISPLAY MENU
```

After perusing the data, the user may wish to change some of it:

```
             WOULD YOU LIKE TO CHANGE ANY OF THE DATA (Y or N)
```

If the user answers with YES, he may change any or all of the data provided in the above menu:

```
             INPUT ARRAY NAME, DATA CHANGE, AND INDUSTRY NUMBER
             (OR RANGE OF INDUSTRY NUMBERS)
             TYPE 'M' TO DISPLAY MENU
```

The data arrays are dimensioned by the number of consumables, number of capital items, number of consumption activities, etc. If the user tries to change a piece of data outside its normal range, DYNEVAL will inform the user of his error:

```
EXCUSE ME?
RANGE MUST BE BETWEEN 1 AND 5
(values for example only)
```

When all changes are complete, the user has the option of once again seeing the data either printed on the line printer or displayed on the terminal. If all is in order, the run begins with the calculation of the final equilibrium state. When this is completed, the model tells the user how long the calculation took by printing:

```
CPU TIME TO CALCULATE EQUILIBRIUM = (NUMBER) CPU SECONDS
  FOR (NUMBER) ITERATIONS
```

on the terminal. Following this calculation, the optimal trajectory to this equilibrium state is calculated through the iterative technique of Dynamic Lagrange Programming.

A.3 RESTART

If, for any reason, the user wishes to stop the run, he need only type any character on the terminal. At the beginning of each pass, the program checks to see if the terminal input buffer is empty. If it is not, the model responds with:

```
EXCUSE ME?
YOU HAVE INTERRUPTED ME
TYPE "C" TO CONTINUE, "S" TO STOP
```

The user may then stop the program by typing on "S". All files will be closed and the program will end.

The user may then check the output by printing file PRINT.DAT. If he wishes to continue the run later, he may simply reexecute EREC and answer YES to the question

IS THIS A RESTART?

(see Sec. B). All printer output in a restart is appended to the current version of PRINT.DAT so the initial output is not lost.

In normal operation, a restart is also possible if the program fails for some reason, e.g., because of a system crash, as long as the failure did not occur while the insurance file was being written. The insurance file is rewritten after each pass and the output file (PRINT.DAT) is closed to save the output and then reopened in the append mode. To be safe, however, it is advisable to stop the program with a FORTRAN interrupt as described above.

A.4 TERMINAL OUTPUT

Throughout the course of the run, a summary of each pass is displayed on the terminal, e.g.:

```
PASS 5; 24.320 CPU SEC; 508 LOOPS; FOM = 0.967E-02 0.179 1.000
```

The above summary is for the fifth pass which took 24.32 cpu sec to complete. The number of loops refers to the cumulative total of single time period optimization iterations. There is a maximum number of iterations for any given time period (nominally 20). The three figure-of-merit's are defined for each pass as:

$$\mathrm{FOM}(1) = \frac{\sum_{k=1}^{N} \sum_{i=1}^{M} \bar{R}_{ik} (\Delta R_{ik})^2}{\sum_{k}^{N} \sum_{i}^{M} \bar{R}_{ik}} \tag{1a}$$

$$\mathrm{FOM}(2) = \frac{\sum_{k=1}^{N} \sum_{i=1}^{M} (\Delta\Lambda_{ik})^2 X_{ik}}{\sum_{k=1}^{N} \sum_{i=1}^{M} X_{ik}} \tag{1b}$$

$$\mathrm{FOM}(3) = \frac{\sum_{k=1}^{N} \sum_{i=1}^{M} \Lambda_{ik} X_{ik} \varepsilon_{ik}^2}{\sum_{k=1}^{N} \sum_{i=1}^{M} \Lambda_{ik} X_{ik}} \tag{1c}$$

where $N \equiv$ Number of time periods

$M \equiv$ Number of capital resources

$\bar{R}_{ik} \equiv$ Average inventory of capital i, time period k ($\bar{R}_{ik} = \frac{1}{2}(R_{ik} + R_{ik}$(last pass))

$\Delta R_{ik} \equiv$ Percentage difference in R_{ik} ($\Delta R_{ik} = (R_{ik} - R_{ik}$(last pass))/$\bar{R}_{ik}$)

$\Delta\Lambda_{ik} \equiv$ Percentage difference between value of capital and effective cost of producing capital

$\Lambda_{ik} \equiv$ Effective cost of producing capital

$X_{ik} \equiv$ Amount of capital i produced in time period k

$\varepsilon_{ik} \equiv$ Everett parameter (phase two only).

The first figure-of-merit is a measure of how closely the capital inventory trajectory is being reproduced each pass. It is the square root of the average square percentage change in the inventory, weighted by the average size of that inventory. The second figure-of-merit shows how closely the value of the capital, found by propagating the rental values back in time, matches the cost of producing the capital. It is simply the RMS value of the percentage difference of the two weighted by the size of the investment activity. The third figure-of-merit is a measure of how well the Everett algorithm of phase two (see Sec. 6.3.2) is performing. The change in investment activity level, ε_{ik}, is weighted by the total cost of capital produced.

Phase two of the model is started whenever one of the following is achieved:

1. FOM (1) < .005
2. K > 20
3. K > N/2

where K is the current pass number. When phase two begins, the following message is printed on the terminal:

BEGINNING PHASE TWO

The user will notice that after each summary print on the terminal the cursor will remain at the end of the line for a short period and then return to the beginning of the next line. The cursor return is a signal that the insurance file (INS.DAT) has been written. This insurance file is used by the model whenever the user specifies that the run is a restart. It is rewritten at the end of each pass.

A.5 LINE PRINTER OUTPUT

A sample of the line printer output is given in Sec. A.5.1 below. The output from the line printer begins by describing the basic parameter

arrays for this run. These consist of the length of the run, number of consumables, etc., minimum activity levels, utility function elasticity parameters (b), the ratio of post-attack to preattack utility function coefficients (Γ), the input elasticity parameters for the translog substitution function (β) (see Sec. A.2), and the fraction of capital surviving.

Following the above is a listing of the basic data arrays for the economy under study: current activity levels, resource inventories, gestation times, depreciation, growth factors, discounts, direct requirements matrix for consumables, the current capital and labor usage for each production activity, and a summary of the level of the current economy (e.g., GNP).

After these basic arrays, derived current day values for functional parameters are displayed. These include the actual elasticity parameters (β), the utility function coefficients (Γ), the rental values for capital and labor (λ), the translog parameters for the mix of capital and labor (γ) and, if two types of capital are used in a production activity, the translog parameters for the effective capital, and the translog normalization coefficients (e).

The equilibrium values of selected arrays are displayed next. These include the new utility function coefficients (Γ), resource inventories, activity levels, values, and capital rental values. A listing of the productivity of each production industry as a function of the labor/capital ratio is also given as an aid to determining those industries which are capital intensive and those which are labor intensive. Following these arrays is again a summary of equilibrium economic levels.

The output next shows the level of capital inventories at time zero and proceeds to duplicate the terminal output (Sec. A.4). If the user specified during the start-up phase that he wanted detailed prints, then the output will also contain a listing of the inputs and outputs as shown in Fig. A-1.

--------------- INPUT FOR PERIOD 9										
R	0.6529E+05	0.4390E+05	0.3007E+05	0.1495E+06	0.5433E+05	0.2902E+05	0.4021E+05	0.2671E+06	0.1030E+07	
FLAM	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
FLAM	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
RIRGT	0.1024E+06	0.6870E+05	0.6334E+05	0.3630E+06	0.1265E+06	0.9000E+05	0.1358E+06	0.8437E+06		
RFUT	0.5748E+05	0.3857E+05	0.3091E+05	0.1375E+06	0.5426E+05	0.2648E+05	0.3728E+05	0.2409E+06		
XIRGT	0.4491E+05	0.3013E+05	0.3242E+05	0.2275E+06	0.7220E+05	0.6353E+05	0.9849E+05	0.6228E+06		
--------------- OUTPUT FROM PERIOD 9										
DLAMB	0.4255E-02	0.8154E-02	10.21	0.3189	0.3488E-01	1.454	14.74	0.2011	0.6728	
X	0.0000	0.0000	5103.	0.2491E+05	0.1412E+05	8415.	0.1532E+05	0.6827E+05	0.2675E+05	0.1064E+05
X	0.8331E+05	0.2767E+06	0.2095E+05	9864.	0.1246E+05	0.1959E+06	0.7656E+06	0.1275E+06	0.2897E+05	5957.
X	0.2548E+05	1881.								
FLAM	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.6728	1.474
FLAM	2.219	5.438	2.377	1.669	6.253	59.95	1.995			
EFFCST	2.958	4.355	2.484	3.214	2.746	4.102	4.379	4.392		
LABOR	1231.	1389.	0.5825E+05	0.8697E+05	8890.	6157.	6524.	0.9520E+05		
LAMPRM	0.4134E-01	0.1214	4.155	0.3837	0.3756	5.228	47.94	0.6012		
TCONS	0.2677E+05	0.1068E+05	0.8293E+05	0.2755E+06	0.2097E+05	8909.	0.1243E+05	0.1959E+06		

Figure A-1. Sample Listing of the Inputs and Outputs

R refers to the capital resource inventory (including labor). In this case there are eight capital items, each used in one of eight production industries. FLAM refers to the value of capital (propagated from the future or, in this case for the first past, set equal to the equilibrium value). The last eight values of FLAM are the values of the eight consumables. These values have meaning only for the output FLAM's. RTRGT, RFUT, and XTRGT refer to the target resource inventory, i.e., the inventory which will occur one gestation time in the future if no investment is made, and the corresponding target activity level. These parameters have meaning and are printed for phase one only. DLAMB is the rental value for capital (and labor). X refers to the activity level of all activities. EFFCST is the cost of production for the capital. LABOR is the amount of labor used in producing each commodity. LAMPRM (Λ') refers to the gross profit for each commodity which may be divided between capital and labor. Finally, TCONS is the total amount of each commodity used or consumed. It should be compared with the total amount X produced (elements 9 - 16 of the X array).

Once the model converges (or reaches the pass limit), the final results are printed. These include the inventory, activity level, shadow value and capital rental value trajectories. Cost of capital production, percentage difference with capital value, and Everett parameters (phase two) are also printed so the extent of convergence may be determined. A summary of the economy (gross consumption, investment, GNP, etc.) ends the output.

A.5.1 Sample Listing of Line Printer Output

THIS RUN CONTINUES FOR 40 TIME PERIODS OF LENGTH 1.00 YEARS

CAPITAL	CONSUMABLES	PROD ACT	CONSPT ACT	TOTAL ACT
14	13	26	16	43

BASIC PARAMETER ARRAYS:

LISTING OF ARRAY MINIMUM ACTIVTY:

C OF LEISURE	CBP-METALS	CBP-ENERGY	CBP-MACH BLDG	CBP-CHEMICALS	CBP-WOOD PROD	CBP-CNSTR MAT	CBP-FOF SUPTFOR
0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00
CBP-AGRICULTURE	CBP-TRANS/COMM	CBP-TRADE/SER	CBP-MIL PROD	CBP-R. ESTATE	C BY MILITARY	C BY FED GOV'T	C BY LOC GOV'T
0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00

LISTING OF ARRAY B(UTILITY-ELAS):

C OF LEISURE	CBP-METALS	CBP-ENERGY	CBP-MACH BLDG	CBP-CHEMICALS	CBP-WOOD PROD	CBP-CNSTR MAT	CBP-FOF SUPTFOR
1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
CBP-AGRICULTURE	CBP-TRANS/COMM	CBP-TRADE/SER	CBP-MIL PROD	CBP-R. ESTATE	C BY MILITARY	C BY FED GOV'T	C BY LOC GOV'T
1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

LISTING OF ARRAY WEIGHT FACTOR:

C OF LEISURE	CBP-METALS	CBP-ENERGY	CBP-MACH BLDG	CBP-CHEMICALS	CBP-WOOD PROD	CBP-CNSTR MAT	CBP-FOF SUPTFOR
1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
CBP-AGRICULTURE	CBP-TRANS/COMM	CBP-TRADE/SER	CBP-MIL PROD	CBP-R. ESTATE	C BY MILITARY	C BY FED GOV'T	C BY LOC GOV'T
1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

LISTING OF ARRAY BETA P-CONSUMBL:

P-METALS	P-ENERGY	P-MACH BLDG	P-CHEMICALS	P-WOOD PROD	P-CNSTR MAT	P-FOF SUPTFORT	P-CONSTRUCTION
-1.750000	-1.270000	-2.250000	-1.500000	-2.500000	-2.500000	-2.000000	-3.000000
P-AGRICULTURE	P-TRANS/COMM	P-TRADE/SER	P-MIL PROD	P-R. ESTATE			
-1.500000	-1.750000	-3.000000	-2.250000	-1.300000			

LISTING OF ARRAY BETA CAPL-TRADE:

K1-METALS	K1-ENERGY	K1-MACH BLDG	K1-CHEMICALS	K1-WOOD PROD	K1-CNSTR MAT	K1-FOF SUPTFORT	K1-CONSTRUCTION
1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
K1-AGRICULTURE	K1-TRANS/COMM	K1-TRADE/SER	K1-MIL PROD	K1-R. ESTATE			
1.000000	1.000000	1.000000	1.000000	1.000000			

LISTING OF ARRAY FRACTIONAL RES:

K1-METALS	K1-ENERGY	K1-MACH BLDG	K1-CHEMICALS	K1-WOOD PROD	K1-CNSTR MAT	K1-FOF SUPTFORT	K1-CONSTRUCTION
0.1220000	0.4420000	0.2630000	0.1920000	0.8700000E-01	0.5200000	0.3520000	0.3040000
K1-AGRICULTURE	K1-TRANS/COMM	K1-TRADE/SER	K1-MIL PROD	K1-R. ESTATE	LABOR		
0.9960000	0.3150000	0.5480000	0.2360000	0.6060000	0.7000000		

BASIC DATA ARRAYS:

LISTING OF ARRAY TODAY'S ACTIVITY:

PK1 METALS	PK1-ENERGY	PK1-MACH BLDG	PK1-CHEMICALS	PK1-WOOD PROD	PK1-CNSTR MAT	PK1 POP SUPPOR	PK1 CONSTRUCTIO
3368.174	6692.506	5581.414	2144.235	1578.449	1870.597	3142.364	3840.767
PK1 AGRICULTURE	PK1-TRANS/COMM	PK1-TRADE/SER	PK1-MIL PROD	PK1-R. ESTATE	P-METALS	P-ENERGY	P MACH BLDG
9996.506	6286.294	17794.85	842.3266	23830.52	40404.91	38762.36	95284.15
P CHEMICALS	P-WOOD PROD	P-CNSTR MAT	P-POP SUPPORT	P-CONSTRUCTION	P-AGRICULTURE	P-TRANS/COMM	P TRADE/SER
27729.20	21352.23	18232.98	172049.4	77306.13	109817.0	29530.00	311013.6
P-MIL PROD	P-R. ESTATE	C OF LEISURE	CBP-METALS	CBP-ENERGY	CBP-MACH BLDG	CBP-CHEMICALS	CBP WOOD PROD
36357.91	91873.59	348958.7	9.186252	3125.291	5522.560	2089.992	3590.045
CBP CNSTR MAT	CBP POP SUPPOR	CBP-AGRICULTURE	CBP-TRANS/COMM	CBP-TRADE/SER	CBP-MIL PROD	CBP-R. ESTATE	C BY MILITARY
431.3950	95089.21	17947.57	2624.437	87239.61	206.0435	55275.20	102188.8
C BY FED GOV'T	C BY LOC GOV'T	EXPORTS					
78411.35	75074.19	-18558.91					

LISTING OF ARRAY RESOURCES:

K1-METALS	K1-ENERGY	K1-MACH BLDG	K1-CHEMICALS	K1-WOOD PROD	K1-CNSTR MAT	K1-POP SUPPORT	K1-CONSTRUCTION
33852.80	71004.32	53223.59	21584.71	12763.53	17371.99	32223.90	23674.00
K1-AGRICULTURE	K1-TRANS/COMM	K1-TRADE/SER	K1-MIL PROD	K1-R. ESTATE	LABOR		
113391.0	64118.00	215288.4	7008.068	348501.0	697917.4		

LISTING OF ARRAY GESTATION TIME:

K1 METALS	K1-ENERGY	K1-MACH BLDG	K1-CHEMICALS	K1-WOOD PROD	K1-CNSTR MAT	K1-POP SUPPORT	K1-CONSTRUCTION
1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
K1 AGRICULTURE	K1-TRANS/COMM	K1-TRADE/SER	K1-MIL PROD	K1-R. ESTATE			
1.000000	1.000000	1.000000	1.000000	1.000000			

LISTING OF ARRAY DEPRECIATION:

K1-METALS	K1-ENERGY	K1-MACH BLDG	K1-CHEMICALS	K1-WOOD PROD	K1-CNSTR MAT	K1 POP SUPPORT	K1 CONSTRUCTION
0.6002458E-01	0.5497129E-01	0.6521018E-01	0.5987201E-01	0.8336248E-01	0.6792545E-01	0.5811834E-01	0.1205710
K1 AGRICULTURE	K1-TRANS/COMM	K1-TRADE/SER	K1-MIL PROD	K1-R. ESTATE	LABOR		
0.4909739E-01	0.5861691E-01	0.4376624E-01	0.7999998E-01	0.3000000E-01	-0.1600000E-01		

LISTING OF ARRAY GROWTH FACTOR:

K1-METALS	K1-ENERGY	K1-MACH BLDG	K1-CHEMICALS	K1-WOOD PROD	K1-CNSTR MAT	K1 POP SUPPORT	K1 CONSTRUCTION
0.1995685E-01	0.1995554E-01	0.1995440E-01	0.1996031E-01	0.1994116E-01	0.1995176E-01	0.1995506E-01	0.1993881E-01
K1 AGRICULTURE	K1-TRANS/COMM	K1-TRADE/SER	K1-MIL PROD	K1-R. ESTATE			
0.1994988E-01	0.1996308E-01	0.1996990E-01	0.1995046E-01	0.1996498E-01			

LISTING OF ARRAY DISCOUNTS:

K1 METALS	K1-ENERGY	K1-MACH BLDG	K1-CHEMICALS	K1-WOOD PROD	K1 CNSTR MAT	K1 POP SUPPORT	K1 CONSTRUCTION
0.1475871	0.1011097	0.1733534	0.1761574	0.1709193	0.1130210	0.3346658	0.2127662

K1 AGRICULTURE	K1-TRANS/COMM	K1-TRADE/SER	K1-MIL PROD	K1-R. ESTATE
0.1263420E-01	0.1052603	0.1468642	0.1203011	0.1031870

LISTING OF ARRAY CONSUMPT MATRIX1

	METALS	ENERGY	MACH BLDG	CHEMICALS	WOOD PROD	CNSTR MAT	FOF SUFFORT
FK1 METALS	0.0000000E+00	0.0000000E+00	0.5339052	0.9242122E-03	0.5195149E-02	0.0000000E+00	0.1524259E 02
FK1 ENERGY	0.0000000E+00	0.0000000E+00	0.2637502	0.3338035E-03	0.2237496E-02	0.0000000E+00	0.7411448E 03
FK1 MACH BLDG	0.0000000E+00	0.0000000E+00	0.4774384	0.3301224E-02	0.9038023E-02	0.0000000E+00	0.5572619E 02
FK1 CHEMICALS	0.0000000E+00	0.0000000E+00	0.5247409	0.2202041E-02	0.9977300E-02	0.0000000E+00	0.2115534E-02
FK1-WOOD PROD	0.0000000E+00	0.0000000E+00	0.6375861	0.1481513E-02	0.5116925E-02	0.0000000E+00	0.2992456E-02
FK1 CNSTR MAT	0.0000000E+00	0.0000000E+00	0.5128831	0.1629828E-02	0.8391145E-02	0.0000000E+00	0.3624789E-02
FK1 FOF SUFFOR	0.0000000E+00	0.0000000E+00	0.4924385	0.2996829E-02	0.1200086E-01	0.0000000E+00	0.3783915E-02
FK1-CONSTRUCTIO	0.0000000E+00	0.0000000E+00	0.7333072	0.3838553E-02	0.8756622E-02	0.0000000E+00	0.7569959E-02
FK1 AGRICULTURE	0.0000000E+00	0.0000000E+00	0.5099697	0.2724242E-03	0.5521960E-03	0.0000000E+00	0.6174359E-03
FK1-TRANS/COMM	0.0000000E+00	0.0000000E+00	0.6145445	0.1364075E-02	0.1284718E-01	0.0000000E+00	0.2738576E 02
FK1 TRADE/SER	0.0000000E+00	0.0000000E+00	0.2509182	0.7611979E-02	0.3147067E-01	0.0000000E+00	0.6658870E 02
FK1-MIL PROD	0.0000000E+00	0.0000000E+00	0.4045463	0.4237252E-02	0.1303131E-01	0.0000000E+00	0.7690175E 02
FK1 R. ESTATE	0.0000000E+00	0.0000000E+00	0.2040362E-01	0.9945005E-04	0.5677900E-03	0.0000000E+00	0.1364409E 03
F METALS	0.3934913	0.1094057	0.1902316E-01	0.1390116E-01	0.4908017E-02	0.1339540E-02	0.6556158E 02
F ENERGY	0.4325123E-02	0.3185376	0.1529871E-01	0.1139809E-01	0.8659405E-02	0.1532492E-02	0.3977905E 02
F MACH BLDG	0.1334667	0.2034505E-01	0.2808307	0.4264331E-01	0.1403103E-01	0.4664081E-02	0.1400797E 01
F CHEMICALS	0.3678804E-01	0.7253216E-01	0.4957499E-01	0.2833547	0.2805465E-01	0.6832111E-02	0.7095537E 01
F WOOD PROD	0.1151823E-01	0.3594233E-01	0.2430214E-01	0.3192856E-01	0.2783711	0.8848256E-02	0.2750415E-01
F CNSTR MAT	0.7012668E-01	0.8668442E-01	0.3206059E-01	0.2824410E-01	0.1990092E-01	0.1446258	0.1246439E-01
F FOF SUFFORT	0.1977490E-02	0.9428473E-02	0.5175049E-02	0.1856879E-01	0.7532785E-02	0.1443440E-02	0.4058378
F CONSTRUCTION	0.4941176E-01	0.1579084E-01	0.8371403E-01	0.1685976E-01	0.5106215E-01	0.1681676	0.9531883E-02
F AGRICULTURE	0.8285696E-03	0.1130126E-01	0.1481201E-01	0.2543439E-01	0.4396187E-02	0.1640147E-02	0.4057692E-01
F TRANS/COMM	0.4508567E-02	0.5877862E-01	0.2664931E-01	0.2166129E-01	0.6234304E-02	0.1183441E-02	0.7573180E-02
F TRADE/SER	0.5907647E-02	0.9117101E-02	0.1472805E-01	0.7013013E-02	0.3710542E-02	0.1617249E-02	0.1295461E 01
F MIL PROD	0.1221468E-01	0.3026487E-02	0.1165687	0.1031623E-01	0.9538441E-02	0.4993549E-03	0.8041419E-02
F R. ESTATE	0.2025622E-03	0.2366141E-02	0.3091555E-02	0.1975474E-02	0.4572986E-03	0.4140225E-02	0.3739263E-02
C OF LEISURE	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00
CBF METALS	1.000000	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00
CBF ENERGY	0.0000000E+00	1.000000	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00
CBF MACH BLDG	0.0000000E+00	0.0000000E+00	1.000000	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00
CBF CHEMICALS	0.0000000E+00	0.0000000E+00	0.0000000E+00	1.000000	0.0000000E+00	0.0000000E+00	0.0000000E+00
CBF WOOD PROD	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	1.000000	0.0000000E+00	0.0000000E+00
CBF CNSTR MAT	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	1.000000	0.0000000E+00
CBF FOF SUFFOR	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	1.000000
CBF AGRICULTURE	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00
CBF TRANS/COMM	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00
CBF TRADE/SER	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00
CBF MIL PROD	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00
CBF R. ESTATE	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00
C BY MILITARY	0.7458413E-03	0.6296863E-02	0.1245289	0.1866901E-01	0.2170495E-02	0.3235083E-03	0.2463509E 01
C BY FED GOV'T	0.3716397E-04	0.6443052E 03	0.1326825E-01	0.3754680E-02	0.9917000E-03	0.1614796E-03	0.1095243E 01
C BY LOC GOV'T	0.4393980E-05	0.7462050E 02	0.9214243E-02	0.5628474E-02	0.4344788E-02	0.1223741E 02	0.1425282E-01
EXPORTS	-0.1241153	-0.1257959	0.1136466	0.1069837	0.7676466E-02	0.1425762E 01	0.6561533

	CONSTRUCTION	AGRICULTURE	TRANS/COMM	TRADE/SER	MIL PROD	R. ESTATE	UNDIFF. IMPORTS
FK1 METALS	0.4353865	0.0000000E+00	0.5796572E-02	0.1726806E-01	0.0000000E+00	0.0000000E+00	0.0000000E+00
FK1 ENERGY	0.7195107	0.0000000E+00	0.3541961E-02	0.9884734E-02	0.0000000E+00	0.0000000E+00	0.0000000E+00
FK1 MACH BLDG	0.4799913	0.0000000E+00	0.4631966E-02	0.2002651E-01	0.0000000E+00	0.0000000E+00	0.0000000E+00
FK1 CHEMICALS	0.4328623	0.0000000E+00	0.8102465E 02	0.1999953E-01	0.0000000E+00	0.0000000E+00	0.0000000E+00
FK1-WOOD PROD	0.3140913	0.0000000E+00	0.8013417E-02	0.3071829E-01	0.0000000E+00	0.0000000E+00	0.0000000E+00
FK1-CNSTR MAT	0.4424064	0.0000000E+00	0.7153676E-02	0.2391107E 01	0.0000000E+00	0.0000000E+00	0.0000000E+00
FK1 FOF SUFFFOR	0.4572448	0.0000000E+00	0.6633398E 02	0.2490166E 01	0.0000000E+00	0.0000000E+00	0.0000000E+00
FK1-CONSTRUCTIO	0.1575169	0.0000000E+00	0.1848728E-01	0.7052349E-01	0.0000000E+00	0.0000000E+00	0.0000000E+00
FK1-AGRICULTURE	0.4377457	0.0000000E+00	0.8227059E-02	0.4261554E 01	0.0000000E+00	0.0000000E+00	0.0000000E+00
FK1 TRANS/COMM	0.3325982	0.0000000E+00	0.9764222E-02	0.2614326E-01	0.0000000E+00	0.0000000E+00	0.0000000E+00
FK1 TRADE/SER	0.5942796	0.0000000E+00	0.5550806E-02	0.9926859E-01	0.4241281E-02	0.0000000E+00	0.0000000E+00
FK1 MIL PROD	0.5089821	0.0000000E+00	0.4649129E-02	0.2178818E 01	0.3507564E-01	0.0000000E+00	0.0000000E+00
FK1 R. ESTATE	0.9574860	0.0000000E+00	0.2117805E 03	0.3619775E 02	0.7409074E 04	0.1738101E 01	0.0000000E+00
F METALS	0.0000000E+00	0.6501683E 04	0.5619285E-01	0.4282328E-01	0.0000000E+00	0.0000000E+00	0.0000000E+00

F ENERGY	0.0000000E+00	0.2958137E 04	[illegible]	0.1803327E-01	0.0000000E+00	0.0000000E+00	0.7687930E-02
F MACH BLDG	0.0000000E+00	0.1990087E 04	0.3110470E 01	0.1450749E-01	0.0000000E+00	0.0000000E+00	0.4030421E-01
F CHEMICALS	0.0000000E+00	0.1022713E 04	0.3574232E 01	0.1657783E-01	0.0000000E+00	0.0000000E+00	0.3017755E-01
F WOOD PROD	0.0000000E+00	0.2060721E 01	0.7282892E 01	0.2045482E-01	0.0000000E+00	0.0000000E+00	0.1336444E-02
F CNSTR MAT	0.0000000E+00	0.2134045E 03	0.8945643E 01	0.2447060E-01	0.0000000E+00	0.0000000E+00	0.0000000E+00
F POP SUPPORT	0.0000000E+00	0.3293303	0.1395490E-01	0.1924466E-01	0.0000000E+00	0.0000000E+00	0.0000000E+00
F CONSTRUCTION	0.0000000E+00	0.6019961E 03	0.7556153E-01	0.2182458E-01	0.0000000E+00	0.0000000E+00	0.0000000E+00
F AGRICULTURE	0.0000000E+00	0.2025398	0.1065051E 01	0.6818543E-01	0.0000000E+00	0.0000000E+00	0.0000000E+00
F TRANS/COMM	0.0000000E+00	0.1596004E-03	0.1349462E 01	0.1231575E-01	0.0000000E+00	0.0000000E+00	0.0000000E+00
F TRADE/SER	0.0000000E+00	0.1522127E-01	0.5878622E-02	0.1197978	0.1423234E-05	0.3003834E-01	0.0000000E+00
F MIL PROD	0.0000000E+00	0.0000000E+00	0.2796445E-02	0.7380478E-01	0.2146931	0.1963522E-01	0.0000000E+00
F R. ESTATE	0.0000000E+00	0.1024187	0.2689030E-02	0.9007187E-01	0.2527006E-03	0.3036486E-01	0.0000000E+00
C OF LEISURE	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00
CBF METALS	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00
CBF ENERGY	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00
CBF MACH BLDG	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00
CBF CHEMICALS	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00
CBF WOOD PROD	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00
CBF CNSTR MAT	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00
CBF POP SUPPOR	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00
CBF AGRICULTURE	0.0000000E+00	1.000000	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00
CBF TRANS/COMM	0.0000000E+00	0.0000000E+00	1.000000	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00
CBF TRADE/SER	0.0000000E+00	0.0000000E+00	0.0000000E+00	1.000000	0.0000000E+00	0.0000000E+00	0.0000000E+00
CBF MIL PROD	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	1.000000	0.0000000E+00	0.0000000E+00
CBF R. ESTATE	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	1.000000	0.0000000E+00
C BY MILITARY	0.1608992E-01	0.2454489E-02	0.2036731E-01	0.5472500	0.2334958	0.2972812E-02	0.0000000E+00
C BY FED GOV'T	0.2811292E-01	0.5330520E-03	0.1520822E-02	0.6188870	0.3735258E-01	0.2837836	0.0000000E+00
C BY LOC GOV'T	0.2652761	0.6788055E-02	0.4878221E-02	0.6704622	0.1024738E-03	0.1036239E-01	0.0000000E+00
EXPORTS	0.0000000E+00	0.1351911	0.0000000E+00	0.2290760E-01	-0.7651621E-01	0.0000000E+00	0.2696111

LISTING OF ARRAY RENTAL MATRIX:

K1 METALS	K1-ENERGY	K1-MACH BLDG	K1-CHEMICALS	K1-WOOD PROD	K1-CNSTR MAT	K1-POP SUPPORT	K1-CONSTRUCTION
0.2451816	0.4034540	0.1890439	0.2617792	0.2133803	0.2398692	0.1162855	0.1449717

K1 AGRICULTURE	K1-TRANS/COMM	K1-TRADE/SER	K1-MIL PROD	K1-R. ESTATE
0.1301526	0.4995558	0.1883511	0.5323508E-01	0.7375128

LISTING OF ARRAY LABOR RENTAL:

P METALS	P-ENERGY	P-MACH BLDG	P-CHEMICALS	P-WOOD PROD	P-CNSTR MAT	P-POP SUPPORT	P-CONSTRUCTION
0.1071121	0.1356055	0.2180309	0.1066084	0.2529775	0.2518835	0.7122079E-01	0.3625021

P AGRICULTURE	P-TRANS/COMM	P-TRADE/SER	P-MIL PROD	P-R. ESTATE
0.4894822	0.3478855	0.5856633	0.4756301	0.2071750E-01

CURRENT ECONOMY:

*** TOTAL CONSUMPTION (EXCLUDING LEISURE) = 0.51026E+06
*** TOTAL INVESTMENT = 86969.
*** GNP = 0.59722E+06
*** TOTAL PRODUCTION = 0.10697E+07
*** TOTAL CAPITAL INVENTORY = 0.10140E+07

0

CURRENT ECONOMY -- DERIVED PARAMETERS:

LISTING OF ARRAY BETA P-CONSUMBL:

P METALS	P-ENERGY	P-MACH BLDG	P-CHEMICALS	P-WOOD PROD	P-CNSTR MAT	P-POP SUPPORT	P-CONSTRUCTION
0.6477054	1.212414	0.9458493	0.8425734	0.8533067	0.7834654	0.6892677	1.140445

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P-AGRICULTURE  P-TRANS/COMM   P-TRADE/SER    P-MIL PROD     P-R. ESTATE
  3.848476       0.9444021      1.286426       2.831336       0.1055926
------------------------------------------------------------------------------------------------------------

                                    LISTING OF ARRAY  UTILITY WEIGHT:

C OF LEISURE   CBP-METALS     CBP-ENERGY     CBP-MACH BLDG  CBP-CHEMICALS  CBP-WOOD PROD  CBP-CNSTR MAT  CBP-POP SUPPOR
  348958.7       9.186252       3125.291       5522.560       2089.992       3590.045       421.3950       95089.21

CBP-AGRICULTURE CBP-TRANS/COMM CBP-TRADE/SER CBP-MIL PROD   CBP-R. ESTATE  C BY MILITARY  C BY FED GOV'T C BY LOC GOV'T
  17947.57       2624.437       87239.61       206.0435       55275.20       102188.8       78411.25       75074.19
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                                    LISTING OF ARRAY    RENTAL VALUE:

K1-METALS      K1-ENERGY      K1-MACH BLDG   K1-CHEMICALS   K1-WOOD PROD   K1-CNSTR MAT   K1-POP SUPPORT K1-CONSTRUCTION
  0.2926358      0.2202518      0.3384380      0.3362996      0.3569658      0.2517576      0.6208700      0.4733970

K1-AGRICULTURE K1-TRANS/COMM  K1-TRADE/SER   K1-MIL PROD    K1-R. ESTATE      LABOR
  0.1260503      0.2300740      0.2720989      0.2761840      0.1944268      1.000000
------------------------------------------------------------------------------------------------------------

                                    LISTING OF ARRAY  FRACTN CAPITAL:

P-METALS       P-ENERGY       P-MACH BLDG    P-CHEMICALS    P-WOOD PROD    P-CNSTR MAT    P-POP SUPPORT  P-CONSTRUCTION
  0.8966385      0.9858853      0.6785588      0.9291334      0.6372681      0.7297712      0.7607353      0.2480850

P-AGRICULTURE  P-TRANS/COMM   P-TRADE/SER    P-MIL PROD     P-R. ESTATE
  0.8246236      0.8900484      0.2850784      0.8600607E-02  0.9840535
------------------------------------------------------------------------------------------------------------
POSITIVE GAMMA IMPLIES GAMMA FOR CAPITAL; NEGATIVE GAMMA IMPLIES GAMMA FOR LABOR
(GAMMA(K) + GAMMA(L) = 1.0)
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                                    LISTING OF ARRAY CAPITAL FRACTNS:

K1-METALS      K1-ENERGY      K1-MACH BLDG   K1-CHEMICALS   K1-WOOD PROD   K1-CNSTR MAT   K1-POP SUPPORT K1-CONSTRUCTION
  1.000000       1.000000       1.000000       1.000000       1.000000       1.000000       1.000000       1.000000

K1-AGRICULTURE K1-TRANS/COMM  K1-TRADE/SER   K1-MIL PROD    K1-R. ESTATE
  1.000000       1.000000       1.000000       1.000000       1.000000
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                                    LISTING OF ARRAY NORMALIZE (K-K):

K1-METALS      K1-ENERGY      K1-MACH BLDG   K1-CHEMICALS   K1-WOOD PROD   K1-CNSTR MAT   K1-POP SUPPORT K1-CONSTRUCTION
  1.000000       1.000000       1.000000       1.000000       1.000000       1.000000       1.000000       1.000000

K1-AGRICULTURE K1-TRANS/COMM  K1-TRADE/SER   K1-MIL PROD    K1-R. ESTATE
  1.000000       1.000000       1.000000       1.000000       1.000000
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                                    LISTING OF ARRAY NORMALIZE (ACT):

P-METALS       P-ENERGY       P-MACH BLDG    P-CHEMICALS    P-WOOD PROD    P-CNSTR MAT    P-POP SUPPORT  P-CONSTRUCTION
  1.764912       0.6852305      2.673281       1.766022       2.466580       1.755182       7.181197       2.885483

P-AGRICULTURE  P-TRANS/COMM   P-TRADE/SER    P-MIL PROD     P-R. ESTATE
  1.381725       0.7124543      1.633795       2.176102       0.2943166
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                                   EQUILIBRIUM FOR STUDY ECONOMY:

NOTE: POPULATION = .700 * (TODAY'S POPULATION) * EXP( 0.015 * T)
RESOURCES, ETC., ARE NORMALIZED TO TODAY'S POPULATION
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LISTING OF ARRAY UTILITY WEIGHT:

C OF LEISURE	CBP METALS	CBP ENERGY	CBP MACH BLDG	CBP CHEMICALS	CBP WOOD PROD	CBP CNSTR MAT	CBP POP SUPPOR
140958.7	9.186252	3125.291	5522.560	2089.992	3590.045	421.3950	95089.21
CBP AGRICULTURE	CBP TRANS/COMM	CBP TRADE/SER	CBP MIL PROD	CBP R. ESTATE	C BY MILITARY	C BY FED GOV'T	C BY LOC GOV'T
17942.57	2624.437	87239.61	206.0435	55275.20	102188.8	78411.75	75074.19

LISTING OF ARRAY INVENTORY:

K1 METALS	K1-ENERGY	K1-MACH BLDG	K1-CHEMICALS	K1-WOOD PROD	K1-CNSTR MAT	K1-POP SUPPORT	K1-CONSTRUCTION
33454.54	73531.24	52991.30	22865.76	13379.42	16911.32	36206.03	22240.79
K1 AGRICULTURE	K1-TRANS/COMM	K1-TRADE/SER	K1 MIL PROD	K1-R. ESTATE	LABOR		
128742.1	66721.36	244155.1	7762.385	404983.8	697917.4		

LISTING OF ARRAY ACTIVITIES:

PK1-METALS	PK1-ENERGY	PK1-MACH BLDG	PK1-CHEMICALS	PK1-WOOD PROD	PK1-CNSTR MAT	PK1-POP SUPPOR	PK1-CONSTRUCTIO
2582.447	5292.801	4368.289	1757.586	1348.829	1441.530	2724.144	3085.631
PK1-AGRICULTURE	PK1-TRANS/COMM	PK1-TRADE/SER	PK1-MIL PROD	PK1-R. ESTATE	P-METALS	P-ENERGY	P-MACH BLDG
8481.333	5051.903	14838.20	758.0604	18952.61	38436.84	39046.24	89938.44
P-CHEMICALS	P-WOOD PROD	P-CNSTR MAT	P-POP SUPPORT	P-CONSTRUCTION	P-AGRICULTURE	P-TRANS/COMM	P-TRADE/SER
28409.47	21152.92	16691.57	186236.9	68565.36	118187.2	29264.96	330295.9
P-MIL PROD	P-R. ESTATE	C OF LEISURE	CBP-METALS	CBP-ENERGY	CBP-MACH BLDG	CBP-CHEMICALS	CBP-WOOD PROD
38487.19	106278.4	345356.4	10.40350	3604.783	6035.782	2338.897	3916.307
CBP-CNSTR MAT	CBP-POP SUPPOR	CBP-AGRICULTURE	CBP-TRANS/COMM	CBP-TRADE/SER	CBP-MIL PROD	CBP R. ESTATE	C BY MILITARY
467.5374	102658.5	19013.15	2956.428	91658.79	213.8847	66366.84	108082.0
C BY FED GOV'T	C BY LOC GOV'T	EXPORTS					
85539.49	79655.17	-17843.03					

LISTING OF ARRAY CAPITAL VALUE:

K1 METALS	K1 ENERGY	K1-MACH BLDG	K1-CHEMICALS	K1-WOOD PROD	K1-CNSTR MAT	K1-POP SUPPORT	K1-CONSTRUCTION
0.9219280	0.9259411	0.9227261	0.9219158	0.9205637	0.9222541	0.9225042	0.9194231
K1 AGRICULTURE	K1-TRANS/COMM	K1 TRADE/SER	K1-MIL PROD	K1-R. ESTATE	LABOR		
0.9228258	0.9206357	0.9274817	0.9249289	0.9279127	1.010431		

LISTING OF ARRAY CONSUMABL VALUE:

METALS	ENERGY	MACH BLDG	CHEMICALS	WOOD PROD	CNSTR MAT	POP SUPPORT	CONSTRUCTION
0.8829962	0.8669045	0.9149701	0.8935801	0.9166914	0.9013075	0.9262669	0.9298393
AGRICULTURE	TRANS/COMM	TRADE/SER	MIL PROD	R. ESTATE			
0.9439556	0.8877054	0.9517866	0.9633393	0.8328737			

LISTING OF ARRAY RENTAL VALUE:

K1 METALS	K1-ENERGY	K1 MACH BLDG	K1-CHEMICALS	K1-WOOD PROD	K1-CNSTR MAT	K1-POP SUPPORT	K1-CONSTRUCTION
0.2427932	0.1791334	0.2830599	0.2815758	0.2999498	0.2066483	0.5354940	0.4037497
K1 AGRICULTURE	K1-TRANS/COMM	K1 TRADE/SER	K1 MIL PROD	K1-R. ESTATE	LABOR		
0.9460392E-01	0.1069505	0.2255437	0.2292777	0.1559554	1.010431		

0 PRODUCTIVITY VERSUS NORMALIZED LABOR TO CAPITAL RATIO1

0 RATIO	METALS	ENERGY	MACH BLDG	CHEMICALS	WOOD PROD	CNSTR MAT	POP SUPPORT
0.01	0.5305796E-01	0.3093184E-01	0.1912492E-01	0.4108076E-01	0.1908600E-01	0.2273637E-01	0.3700930E-01
0.02	0.9714547E-01	0.6112959E-01	0.3784191E-01	0.7857924E-01	0.3956547E-01	0.4444067E-01	0.7000700E-01
0.03	0.1359099	0.9049818E-01	0.5618015E-01	0.1132911	0.5852305E-01	0.6533165E-01	0.1003218
0.04	0.1707851	0.1190007	0.7415904E-01	0.1456606	0.7701012E-01	0.8551804E-01	0.1285312
0.05	0.2026055	0.1466246	0.9179434E-01	0.1760026	0.9506229E-01	0.1050739	0.1549945
0.06	0.2319267	0.1733711	0.1090997	0.2045586	0.1127078	0.1240554	0.1799643
0.07	0.2591473	0.1992504	0.1260874	0.2315226	0.1299701	0.1425074	0.2036303
0.08	0.2845674	0.2242783	0.1427685	0.2570547	0.1468695	0.1604675	0.2261413
0.09	0.3084212	0.2484748	0.1591533	0.2812898	0.1634238	0.1779675	0.2476177
0.10	0.3308962	0.2710623	0.1752515	0.3043431	0.1796489	0.1950353	0.2681591
0.20	0.5041736	0.4667632	0.3222154	0.4869317	0.3264353	0.3462916	0.4360582
0.30	0.6226911	0.6071227	0.4480240	0.6138026	0.4509629	0.4711362	0.5600993
0.40	0.7117603	0.7108846	0.5572520	0.7084985	0.5587989	0.5773233	0.6579649
0.50	0.7823738	0.7897353	0.6531453	0.7824955	0.6535445	0.6694510	0.7382726
0.60	0.8403669	0.8511751	0.7381105	0.8422305	0.7377240	0.7505550	0.8059671
0.70	0.8892173	0.9001071	0.8139849	0.8916489	0.8131940	0.8227709	0.8641708
0.80	0.9311639	0.9398213	0.8822022	0.9333264	0.8813665	0.8876675	0.9149868
0.90	0.9677307	0.9725849	0.9439013	0.9690258	0.9433430	0.9464352	0.9599007
1.00	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
2.00	1.197064	1.135740	1.370070	1.176536	1.384044	1.361219	1.253627
3.00	1.296480	1.183995	1.567000	1.255965	1.598958	1.564077	1.386575
4.00	1.358946	1.207956	1.690102	1.302056	1.738744	1.697337	1.471475
5.00	1.402738	1.222049	1.774641	1.332469	1.837842	1.792821	1.531493
6.00	1.435555	1.231238	1.836421	1.354177	1.912184	1.865187	1.576682
7.00	1.461286	1.237659	1.883613	1.370519	1.970241	1.922241	1.612207
8.00	1.482131	1.242377	1.920880	1.383306	2.016970	1.968564	1.641030
9.00	1.499443	1.245976	1.951081	1.393607	2.055473	2.007042	1.664985
10.00	1.514104	1.248803	1.976067	1.402099	2.087804	2.039592	1.685277
20.00	1.593037	1.260755	2.099189	1.443910	2.255019	2.212508	1.794287
30.00	1.627174	1.264327	2.145045	1.459740	2.321921	2.284696	1.841043
40.00	1.647035	1.265992	2.169174	1.468237	2.358646	2.325422	1.868029
50.00	1.660302	1.266939	2.184114	1.473592	2.382080	2.351938	1.885931
60.00	1.669914	1.267545	2.194299	1.477300	2.398429	2.370734	1.898823
70.00	1.677262	1.267963	2.201698	1.480031	2.410532	2.384834	1.908626
80.00	1.683098	1.268267	2.207323	1.482133	2.419880	2.395847	1.916375
90.00	1.687868	1.268497	2.211748	1.483804	2.427335	2.404715	1.922682
100.00	1.691854	1.268677	2.215322	1.485167	2.433428	2.412027	1.927933

0 RATIO	CONSTRUCTION	AGRICULTURE	TRANS/COMM	TRADE/SER	MIL PROD	R. ESTATE
0.01	0.1340645E-01	0.1063182E-01	0.2517589E-01	0.1241216E-01	0.1038182E-01	0.8515666
0.02	0.2675385E-01	0.2126364E-01	0.4946949E-01	0.2480049E-01	0.2076362E-01	0.8768385
0.03	0.4003594E-01	0.3189546E-01	0.7296128E-01	0.3715933E-01	0.3114540E-01	0.8911407
0.04	0.5324931E-01	0.4252727E-01	0.9570714E-01	0.4948512E-01	0.4152709E-01	0.9010718
0.05	0.6639167E-01	0.5315907E-01	0.1177529	0.6177514E-01	0.5190867E-01	0.9086509
0.06	0.7946136E-01	0.6379084E-01	0.1391383	0.7402719E-01	0.6229006E-01	0.9147631
0.07	0.9245713E-01	0.7442256E-01	0.1598986	0.8623942E-01	0.7267119E-01	0.9198744
0.08	0.1053780	0.8505422E-01	0.1800655	0.9841024E-01	0.8305198E-01	0.9242602
0.09	0.1182232	0.9568576E-01	0.1996680	0.1105383	0.9343233E-01	0.9280966
0.10	0.1309923	0.1063172	0.2187327	0.1226223	0.1038121	0.9315028
0.20	0.2544413	0.2126064	0.3844698	0.2408483	0.2075503	0.9533128
0.30	0.3702396	0.3187407	0.5156270	0.3539497	0.3110483	0.9655915
0.40	0.4786918	0.4244128	0.6224355	0.4616838	0.4140534	0.9740905
0.50	0.5802239	0.5290705	0.7113130	0.5640221	0.5162381	0.9805622
0.60	0.6752989	0.6318704	0.7865494	0.6610573	0.6172130	0.9857723
0.70	0.7643805	0.7317225	0.8511355	0.7529543	0.7165423	0.9901229
0.80	0.8479152	0.8272759	0.9072340	0.8399207	0.8137622	0.9938516
0.90	0.9263242	0.9171368	0.9564494	0.9221083	0.9084009	0.9971098
1.00	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
2.00	1.543183	1.412257	1.261839	1.583648	1.608235	1.018448
3.00	1.870062	1.479335	1.385542	1.936040	1.990761	1.028791
4.00	2.084704	1.493015	1.450139	2.163651	2.124547	1.035933
5.00	2.235020	1.497021	1.506059	2.319611	2.179890	1.041361
6.00	2.345494	1.498520	1.540135	2.431691	2.207144	1.045725
7.00	2.429260	1.499181	1.565649	2.515365	2.221943	1.049364

8.00	2.495952	1.499510	1.585491	2.579790	2.230631	[illegible]
9.00	2.549190	1.499688	1.601377	2.630663	2.236059	1.055202
10.00	2.592876	1.499792	1.614391	2.671687	2.239623	1.057614
20.00	2.799487	1.499986	1.676882	2.854765	2.248531	1.072972
30.00	2.870298	1.499997	1.699490	2.911817	2.249534	1.081554
40.00	2.905353	1.499999	1.711248	2.938455	2.249793	1.087467
50.00	2.926058	1.500000	1.718483	2.953541	2.249890	1.091956
60.00	2.939641	1.500000	1.723394	2.963118	2.249934	1.095560
70.00	2.949196	1.500000	1.726953	2.969676	2.249958	1.098564
80.00	2.956260	1.500000	1.729652	2.974415	2.249971	1.101134
90.00	2.961683	1.500000	1.731773	2.977982	2.249979	1.103376
100.00	2.965968	1.500000	1.733483	2.980753	2.249985	1.105363

EQUILIBRIUM ECONOMY:

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*** RELATIVE STANDARD OF LIVING =     1.0037
*** TOTAL CONSUMPTION (EXCLUDING LEISURE) =   0.55467E+06
*** TOTAL INVESTMENT =    70683.
*** GNP =    0.62536E+06
*** TOTAL PRODUCTION =    0.11110E+07
*** TOTAL CAPITAL INVENTORY =    0.11239E+07
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1 STARTING RESOURCES:

NOTE: RESOURCES ARE NORMALIZED TO TODAY'S POPULATION

LISTING OF ARRAY   STARTING RES:

K1-METALS	K1 ENERGY	K1-MACH BLDG	K1-CHEMICALS	K1-WOOD PROD	K1-CNSTR MAT	K1-POP SUPPORT	K1-CONSTRUCTION
5900.059	44834.16	19996.86	5920.377	1586.325	12904.90	16204.02	10281.28
K1-AGRICULTURE	**K1-TRANS/COMM**	**K1-TRADE/SER**	**K1-MIL PROD**	**K1-R. ESTATE**	**LABOR**		
161339.1	28853.10	168540.1	2362.720	301702.3	697917.4		

1 DSA ECONOMIC MODEL

```
PASS  1;  59.661 CPU SEC;  469 LOOPS; FOM =   1.00        0.475       1.00
PASS  2;  60.317 CPU SEC;  482 LOOPS; FOM =   0.866E-02   0.256       1.00
PASS  3;  59.771 CPU SEC;  465 LOOPS; FOM =   0.694E-02   0.188       1.00
PASS  4;  65.052 CPU SEC;  517 LOOPS; FOM =   0.620E-02   0.198       1.00
PASS  5;  56.433 CPU SEC;  441 LOOPS; FOM =   0.536E-02   0.167       1.00
PASS  6;  58.743 CPU SEC;  465 LOOPS; FOM =   0.478E-02   0.156       1.00

*** BEGINNING PHASE 2 ***

PASS  7; 105.233 CPU SEC;  824 LOOPS; FOM =   0.523E-01   0.148       0.650E-01
PASS  8;  61.427 CPU SEC;  484 LOOPS; FOM =   0.183E-01   0.204       0.529E-01
PASS  9;  61.179 CPU SEC;  468 LOOPS; FOM =   0.179E-01   0.136       0.548E-01
PASS 10;  64.086 CPU SEC;  503 LOOPS; FOM =   0.176E-01   0.148       0.660E-01
PASS 11;  63.935 CPU SEC;  503 LOOPS; FOM =   0.184E-01   0.137       0.573E-01
PASS 12;  54.609 CPU SEC;  442 LOOPS; FOM =   0.110E-01   0.112       0.519E-01
PASS 13;  52.799 CPU SEC;  414 LOOPS; FOM =   0.922E-02   0.110       0.510E-01
PASS 14;  54.357 CPU SEC;  433 LOOPS; FOM =   0.868E-02   0.118       0.416E-01
PASS 15;  55.591 CPU SEC;  435 LOOPS; FOM =   0.851E-02   0.896E-01   0.353E-01
PASS 16;  54.539 CPU SEC;  421 LOOPS; FOM =   0.943E-02   0.793E-01   0.399E-01
PASS 17;  53.305 CPU SEC;  424 LOOPS; FOM =   0.908E-02   0.686E-01   0.339E-01
PASS 18;  50.952 CPU SEC;  402 LOOPS; FOM =   0.702E-02   0.665E-01   0.382E-01
PASS 19;  54.573 CPU SEC;  435 LOOPS; FOM =   0.828E-02   0.655E-01   0.438E-01
PASS 20;  55.690 CPU SEC;  428 LOOPS; FOM =   0.102E-01   0.578E-01   0.368E-01
PASS 21;  64.183 CPU SEC;  510 LOOPS; FOM =   0.909E-02   0.645E-01   0.368E-01
PASS 22;  59.127 CPU SEC;  484 LOOPS; FOM =   0.609E-02   0.575E-01   0.329E-01
PASS 23;  57.655 CPU SEC;  463 LOOPS; FOM =   0.607E-02   0.581E-01   0.328E-01
PASS 24;  55.207 CPU SEC;  432 LOOPS; FOM =   0.536E-02   0.486E-01   0.323E-01
PASS 25;  55.068 CPU SEC;  431 LOOPS; FOM =   0.548E-02   0.403E-01   0.295E-01
PASS 26;  50.475 CPU SEC;  458 LOOPS; FOM =   0.570E-02   0.301E-01   0.263E-01
PASS 27;  57.077 CPU SEC;  459 LOOPS; FOM =   0.464E-02   0.321E-01   0.256E-01
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PASS  28;  59.599 CPU SEC;  480 LOOPS; FOM =  0.408E-02  0.337E-01  0.323E-01
PASS  29;  62.530 CPU SEC;  497 LOOPS; FOM =  0.592E-02  0.319E-01  0.220E-01
PASS  30;  53.434 CPU SEC;  428 LOOPS; FOM =  0.315E-02  0.245E-01  0.192E-01
PASS  31;  66.914 CPU SEC;  537 LOOPS; FOM =  0.399E-02  0.221E-01  0.207E-01
PASS  32;  51.180 CPU SEC;  403 LOOPS; FOM =  0.263E-02  0.228E-01  0.206E-01
PASS  33;  57.631 CPU SEC;  459 LOOPS; FOM =  0.369E-02  0.193E-01  0.212E-01
PASS  34;  51.821 CPU SEC;  411 LOOPS; FOM =  0.275E-02  0.264E-01  0.261E-01
PASS  35;  59.167 CPU SEC;  474 LOOPS; FOM =  0.357E-02  0.324E-01  0.256E-01
PASS  36;  59.473 CPU SEC;  454 LOOPS; FOM =  0.345E-02  0.228E-01  0.331E-01
PASS  37;  55.620 CPU SEC;  429 LOOPS; FOM =  0.347E-02  0.227E-01  0.165E-01
PASS  38;  55.843 CPU SEC;  448 LOOPS; FOM =  0.289E-02  0.182E-01  0.119E-01
PASS  39;  52.194 CPU SEC;  417 LOOPS; FOM =  0.204E-02  0.176E-01  0.130E-01
PASS  40;  54.408 CPU SEC;  422 LOOPS; FOM =  0.223E-02  0.191E-01  0.140E-01
PASS  41;  45.198 CPU SEC;  348 LOOPS; FOM =  0.176E-02  0.168E-01  0.169E-01
PASS  42;  57.591 CPU SEC;  448 LOOPS; FOM =  0.213E-02  0.156E-01  0.224E-01
PASS  43;  56.214 CPU SEC;  437 LOOPS; FOM =  0.320E-02  0.173E-01  0.140E-01
PASS  44;  58.329 CPU SEC;  452 LOOPS; FOM =  0.198E-02  0.139E-01  0.117E-01
PASS  45;  55.960 CPU SEC;  432 LOOPS; FOM =  0.156E-02  0.141E-01  0.980E-02
PASS  46;  54.656 CPU SEC;  433 LOOPS; FOM =  0.145E-02  0.135E-01  0.115E-01
PASS  47;  55.012 CPU SEC;  428 LOOPS; FOM =  0.222E-02  0.144E-01  0.114E-01
PASS  48;  57.192 CPU SEC;  446 LOOPS; FOM =  0.149E-02  0.143E-01  0.953E-02
PASS  49;  52.386 CPU SEC;  405 LOOPS; FOM =  0.192E-02  0.106E-01  0.821E-02
PASS  50;  56.532 CPU SEC;  430 LOOPS; FOM =  0.109E-02  0.114E-01  0.696E-02
PASS  51;  55.137 CPU SEC;  429 LOOPS; FOM =  0.133E-02  0.110E-01  0.722E-02
PASS  52;  53.612 CPU SEC;  401 LOOPS; FOM =  0.125E-02  0.906E-02  0.815E-02
1                                    FINAL MODEL RESULTS:
CONVERGENCE ON PASS  52
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LISTING OF ARRAY INVENTORY:

	K1-METALS	K1-ENERGY	K1-MACH BLDG	K1-CHEMICALS	K1-WOOD PROD	K1-CNSTR MAT	K1-PUP SUPPORT
PER 1	5959.227	45283.74	20197.37	5979.759	1602.221	13034.29	16366.50
PER 2	9370.546	44143.26	19588.15	7505.920	2227.287	12623.96	15929.22
PER 3	14525.34	41118.94	21304.19	10017.25	3729.991	11607.73	14791.27
PER 4	18168.41	41299.85	26514.93	11840.16	5189.048	10673.30	16395.72
PER 5	21494.77	44832.60	32206.58	13397.71	6442.528	9814.100	19385.91
PER 6	24379.03	49997.17	37412.10	15039.87	7396.271	10342.15	22054.57
PER 7	26548.44	55298.25	40630.37	16460.99	8649.779	12629.55	24627.81
PER 8	28306.08	59417.26	43012.95	17637.19	10159.92	15090.41	25916.59
PER 9	30485.44	62832.38	45601.81	18577.53	10883.53	16460.52	26733.05
PER 10	31987.94	65012.09	47660.84	19258.08	11416.63	16988.19	27583.29
PER 11	32506.15	66718.60	49246.97	19837.88	11943.75	17404.94	28650.63
PER 12	32967.20	68374.79	50138.30	20388.83	12249.77	17514.80	29761.33
PER 13	33309.08	69545.15	50829.71	20912.09	12502.34	17562.87	30715.88
PER 14	33547.56	70342.12	51466.79	21291.70	12677.41	17601.78	31634.59
PER 15	33565.00	70933.81	51759.08	21561.98	12794.53	17457.71	32562.25
PER 16	33542.73	71438.36	51984.85	21828.81	12900.64	17348.50	33262.74
PER 17	33568.70	71725.54	52099.16	22048.19	12968.78	17236.38	33751.75
PER 18	33372.66	71997.16	52358.46	22211.67	13035.28	17094.40	34211.35
PER 19	33185.33	72338.39	52527.13	22337.40	13089.98	16969.88	34427.33
PER 20	33219.41	72597.29	52549.64	22426.83	13098.86	16872.30	34768.46
PER 21	33259.56	72755.68	52676.83	22512.99	13189.88	16801.26	35159.89
PER 22	33251.56	72747.46	52739.83	22576.41	13247.49	16768.93	35327.99
PER 23	33288.85	72983.58	52794.94	22601.90	13226.63	16783.76	35446.92
PER 24	33337.11	73256.89	52796.49	22671.17	13238.52	16838.97	35472.47
PER 25	33359.68	73275.66	52743.17	22723.28	13233.29	16902.07	35528.74
PER 26	33317.32	73282.04	52835.45	22712.05	13234.00	16897.49	35562.63
PER 27	33217.67	73327.51	52836.49	22733.45	13243.03	16866.55	35620.33
PER 28	33168.01	73334.63	52635.65	22780.58	13256.93	16867.24	35721.92
PER 29	33142.62	73244.12	52489.41	22801.25	13250.99	16824.50	35814.22
PER 30	33101.87	73306.14	52459.58	22820.94	13231.27	16742.81	35805.90
PER 31	33097.52	73352.79	52500.91	22816.48	13225.41	16671.72	35714.13
PER 32	33092.32	73193.98	52591.89	22785.03	13232.62	16614.56	35638.54
PER 33	33033.62	73272.47	52737.76	22825.00	13237.57	16571.17	35677.33
PER 34	33084.[illegible]	73300.83	52805.56	22859.72	13209.19	16560.95	35755.93

FER	35	[illegible]	[illegible]	[illegible]	22836.45	13205.67	16681.02	35731.46
FER	36	33288.32	73473.69	52803.97	22801.94	13240.52	16656.93	35740.70
FER	37	33433.24	73483.63	52791.17	22845.17	13243.87	16810.22	35737.89
FER	38	33411.62	73409.87	52637.58	22906.61	13314.52	16905.00	35679.46
FER	39	33300.43	73492.34	52499.80	22868.93	13343.47	16926.08	35677.67
FER	40	33184.56	73315.26	52523.91	22818.50	13292.13	16870.66	35804.84

		K1-CONSTRUCTION	K1 AGRICULTURE	K1 TRANS/COMM	K1 TRADE/SER	K1-MIL PROD	K1-R. ESTATE	LABOR
FER	1	10384.29	162956.5	29142.54	170231.4	2386.407	304729.1	697917.4
FER	2	9796.038	159319.2	28356.95	166877.5	2297.368	300788.0	697917.4
FER	3	8545.518	149278.3	26318.05	157196.1	2812.684	287265.2	697917.4
FER	4	7454.635	139870.2	28592.24	148076.3	3601.033	274350.3	697917.4
FER	5	9558.933	131055.1	34925.58	139485.6	3998.585	262016.0	697917.4
FER	6	13711.71	122795.5	41290.10	135528.0	4429.878	250236.3	697917.4
FER	7	17609.65	115056.4	47020.09	142379.5	4896.965	242297.6	697917.4
FER	8	21222.95	107805.2	51369.86	154949.8	5315.307	244840.1	697917.4
FER	9	23111.51	101010.9	55304.38	167660.2	5652.871	259290.0	697917.4
FER	10	23871.32	97955.57	58213.10	179521.9	5988.251	280115.4	697917.4
FER	11	24105.88	99750.68	59812.70	189905.8	6300.907	300263.3	697917.4
FER	12	24111.33	103456.4	61232.32	199212.2	6570.028	317627.1	697917.4
FER	13	23922.78	107606.3	62326.49	207032.1	6796.680	332740.5	697917.4
FER	14	23674.02	110903.6	63216.83	213877.7	6950.701	345647.5	697917.4
FER	15	23482.31	114088.1	64023.14	219074.9	7079.858	356675.6	697917.4
FER	16	23211.40	116908.3	64551.20	223481.7	7216.441	365741.2	697917.4
FER	17	23000.62	119202.9	64858.53	227553.8	7318.016	373100.0	697917.4
FER	18	22736.49	121195.5	65137.29	230878.5	7392.083	378685.2	697917.4
FER	19	22502.33	123191.3	65250.70	233112.3	7453.448	383115.5	697917.4
FER	20	22341.89	124772.1	65252.02	234709.3	7516.942	386516.3	697917.4
FER	21	22139.89	125208.5	65621.59	236181.7	7551.206	389087.5	697917.4
FER	22	22105.42	126050.8	65905.09	237203.9	7568.321	390940.6	697917.4
FER	23	22132.01	126763.2	66015.32	238005.0	7576.534	392164.6	697917.4
FER	24	22157.94	126800.3	66306.51	238749.0	7589.111	393298.7	697917.4
FER	25	22190.36	127288.7	66382.47	239153.0	7629.659	394385.4	697917.4
FER	26	22193.77	127837.5	66290.08	239428.6	7641.655	395545.5	697917.4
FER	27	22191.47	128015.2	66220.25	240031.4	7645.341	396601.0	697917.4
FER	28	22138.57	128222.7	66186.85	240733.4	7658.640	397288.6	697917.4
FER	29	22116.50	128329.1	66157.27	241395.6	7667.527	397737.5	697917.4
FER	30	22059.13	128376.8	66142.26	241471.0	7670.855	398371.4	697917.4
FER	31	21963.16	128213.7	66158.21	241171.0	7665.744	399297.5	697917.4
FER	32	21846.86	127981.4	66162.38	241106.7	7663.628	400032.4	697917.4
FER	33	21747.51	127675.3	66192.94	241402.6	7676.389	399874.8	697917.4
FER	34	21776.89	127737.6	66200.14	241405.3	7681.336	399394.9	697917.4
FER	35	21796.26	128386.3	66140.50	241071.9	7668.589	398930.3	697917.4
FER	36	21856.23	128455.3	66182.36	240999.1	7661.969	398359.7	697917.4
FER	37	22034.95	128189.6	66315.80	240940.8	7670.233	397995.5	697917.4
FER	38	22292.60	128140.3	66573.27	240745.1	7667.399	398186.5	697917.4
FER	39	22339.46	128045.4	66649.99	241011.1	7659.570	398851.1	697917.4
FER	40.	22106.79	127840.0	66482.04	242006.5	7691.313	399699.3	697917.4

LISTING OF ARRAY ACTIVITIES:

		FK1 METALS	FK1 ENERGY	FK1-MACH BLDG	FK1-CHEMICALS	FK1-WOOD PROD	FK1-CNSTR MAT	FK1-FOP SUPPFOR
FER	1	7406.473	0.0000000E+00	0.0000000E+00	3502.174	1432.057	0.0000000E+00	0.0000000E+00
FER	2	4966.779	0.0000000E+00	6727.237	2965.093	2206.577	0.0000000E+00	0.0000000E+00
FER	3	4966.080	6301.492	7792.556	2436.449	1674.761	0.0000000E+00	5508.909
FER	4	4863.148	7175.222	8609.808	2671.685	2040.038	0.0000000E+00	3306.363
FER	5	4550.957	10111.57	7737.587	2856.113	1315.049	2735.292	5205.365
FER	6	3808.265	8291.884	5295.993	2469.279	2817.280	3851.611	3572.597
FER	7	3999.362	8354.233	6427.945	2549.508	2169.442	3523.239	2867.485
FER	8	4955.303	7421.776	6154.237	2161.778	1444.978	1985.708	2759.777
FER	9	2963.613	6250.232	5737.032	2139.334	1880.039	1940.690	3054.235
FER	10	3070.221	6710.994	5490.022	2055.259	1558.654	1841.837	3345.640
FER	11	2927.769	6404.061	4542.874	2164.178	1507.726	1369.393	3312.477
FER	12	2887.994	5930.046	5181.936	2085.362	1505.146	1712.545	3185.416
FER	13	2753.984	[illegible]	[illegible]				

FER	14	2461.711	5613.167	[illegible]	1911.069	1415.608	[illegible]	[illegible]
FER	15	2673.114	5678.773	4475.949	1975.481	1396.953	1418.850	3040.715
FER	16	2566.142	5237.335	4348.085	1855.585	1354.583	1304.924	3001.365
FER	17	2213.228	5671.896	4790.030	1888.418	1404.932	1333.450	3050.738
FER	18	2541.300	5434.951	4219.683	1803.381	1345.530	1318.623	2566.786
FER	19	2655.638	5541.712	4491.511	1829.096	1317.387	1367.958	3324.162
FER	20	2563.318	5267.439	4451.216	1811.103	1517.031	1359.405	2748.922
FER	21	2558.527	5209.971	4377.360	1794.366	1275.402	1436.091	2898.784
FER	22	2655.737	5769.690	4442.120	1741.512	1353.192	1455.014	2677.456
FER	23	2590.534	5339.876	4277.761	1886.928	1343.309	1523.127	2714.988
FER	24	2607.419	5266.915	4322.052	1721.877	1319.362	1483.415	2746.205
FER	25	2460.093	5314.355	4572.855	1757.488	1353.505	1391.608	2678.137
FER	26	2476.864	5350.342	4157.727	1789.061	1338.485	1424.142	2798.012
FER	27	2549.128	5242.737	4137.851	1815.212	1364.719	1453.449	2781.879
FER	28	2522.298	5145.633	4237.691	1742.358	1301.155	1335.312	2793.238
FER	29	2512.485	5542.029	4359.568	1813.598	1331.757	1360.638	2587.632
FER	30	2591.123	5136.470	4385.290	1702.121	1327.628	1344.696	2611.770
FER	31	2513.014	5109.491	4470.229	1744.890	1357.632	1377.007	2608.445
FER	32	2476.604	5603.889	4517.228	1850.722	1325.788	1365.067	2837.261
FER	33	2729.231	5034.142	4333.796	1743.978	1287.633	1438.093	2704.890
FER	34	2653.610	5482.030	4315.937	1731.931	1370.142	1429.225	2630.724
FER	35	2638.805	5498.794	4453.483	1716.697	1370.856	1556.947	2747.647
FER	36	2806.935	5125.977	4238.545	1887.176	1311.429	1607.748	2651.338
FER	37	2322.140	5314.118	4150.925	1767.283	1508.834	1463.219	2609.338
FER	38	2600.060	5445.210	4242.971	1686.740	1248.056	1464.698	2758.435
FER	39	2305.949	4793.508	4468.048	1732.160	1334.631	1308.048	2081.467
FER	40	2618.885	5132.333	4269.672	1649.452	1293.953	1412.410	2642.489

		PK1-CONSTRUCTIO	PK1-AGRICULTURE	PK1-TRANS/COMM	PK1-TRADE/SER	PK1-MIL PROD	PK1-R. ESTATE	P-METALS
FER	1	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	11648.89
FER	2	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	1510.297	0.0000000E+00	17221.76
FER	3	0.0000000E+00	0.0000000E+00	8626.304	0.0000000E+00	737.2565	0.0000000E+00	24158.20
FER	4	6424.879	0.0000000E+00	9058.523	0.0000000E+00	810.8573	0.0000000E+00	27262.75
FER	5	5295.643	0.0000000E+00	9649.494	8528.841	886.6762	0.0000000E+00	30708.79
FER	6	6929.112	0.0000000E+00	8713.880	22074.36	971.0863	6807.323	34008.27
FER	7	5851.199	0.0000000E+00	7610.626	21544.04	878.1658	20967.55	36153.29
FER	8	4201.569	0.0000000E+00	8461.251	23852.26	878.3019	31842.42	37948.17
FER	9	3876.049	6838.481	6103.678	21382.29	937.9410	35656.55	39171.97
FER	10	3279.707	9839.836	6097.504	22150.72	897.6966	32461.27	40041.09
FER	11	3417.939	11114.69	5968.939	20424.73	905.0095	31722.40	40117.72
FER	12	2882.438	11280.43	5630.320	20147.62	860.9176	29423.30	40133.07
FER	13	3205.403	9899.318	5697.405	19342.45	794.9481	28530.98	39789.69
FER	14	2956.936	11432.26	5591.344	17543.00	835.4207	26733.64	39732.78
FER	15	2971.017	9610.522	5237.468	18280.96	836.9086	25474.71	39468.05
FER	16	3011.602	10655.57	5199.990	17401.56	788.6476	24034.28	39332.85
FER	17	2804.949	9318.773	5222.689	17200.84	796.7430	22476.12	39083.31
FER	18	2990.078	10878.68	4899.978	15543.05	776.6997	22140.89	38976.56
FER	19	2909.318	8771.555	4995.693	16105.99	811.9257	20761.67	38786.15
FER	20	2854.306	8653.155	5666.093	15493.63	729.6087	20718.13	38739.76
FER	21	3203.701	9662.922	4897.079	15335.58	778.9035	19522.44	38712.24
FER	22	2996.481	8526.791	5321.386	15155.04	716.6491	19568.70	38602.73
FER	23	3195.791	8324.465	5303.670	15308.59	786.6342	19451.84	38582.72
FER	24	3030.226	9457.175	4918.498	14547.03	780.5433	19573.39	38573.89
FER	25	3132.575	8549.341	4952.294	15069.93	734.6480	19706.11	38539.17
FER	26	3025.886	8732.778	4952.703	15270.15	763.3790	19468.46	38525.61
FER	27	3018.535	8640.001	5017.353	15352.56	756.7076	19042.06	38498.35
FER	28	3076.018	8548.108	4957.986	15274.54	756.4150	19031.51	38414.47
FER	29	2942.195	8529.538	5040.947	14219.05	746.8174	19463.51	38374.37
FER	30	2970.650	8118.424	5022.881	14478.13	739.0350	19700.91	38328.14
FER	31	2875.561	8352.075	5018.295	14677.06	751.7112	19161.26	38286.51
FER	32	2960.283	7943.214	5077.947	15219.30	770.1917	17921.69	38324.14
FER	33	3125.703	9060.173	4976.672	14123.50	738.7461	18456.08	38367.20
FER	34	2965.978	9198.379	4936.932	14494.15	732.8301	17920.97	38382.41
FER	35	3305.738	7951.529	5176.404	14632.09	748.7919	18183.09	38364.58
FER	36	3247.540	8476.172	5141.541	14519.38	763.2985	18298.61	38423.49
FER	37	3422.409	8380.629	5451.045	14330.43	722.9472	19293.15	38489.91

FER	38	2805.044	8372.435	4817.023	15442.83	750.7048	19312.51	38449.83
FER	39	2811.841	8139.948	4933.446	15907.58	809.8859	19732.62	38433.54
FER	40	3115.745	8618.493	4871.617	14288.74	734.3137	19621.47	38371.68

		P-ENERGY	P-MACH BLDG	P-CHEMICALS	P-WOOD PROD	P-CNSTR MAT	P-POP SUPPORT	P-CONSTRUCTION
FER	1	15723.52	26114.06	10423.94	5583.656	4053.669	91855.31	13731.06
FER	2	21082.50	39588.23	13425.70	7663.717	6235.689	98594.43	22757.81
FER	3	23871.94	58905.69	16576.86	10760.33	9048.764	104974.7	35412.59
FER	4	25084.91	69104.82	18371.80	12421.50	9500.498	114097.5	37128.79
FER	5	27411.43	77772.64	20221.48	14495.31	11330.91	128262.0	46007.46
FER	6	30086.93	84700.57	21990.69	16536.20	13756.56	139344.6	58121.92
FER	7	32533.26	86288.99	23460.28	18248.12	16504.68	148910.3	71485.65
FER	8	34428.32	87671.82	24587.05	19855.57	18761.91	152628.2	82594.71
FER	9	35872.65	90034.24	25365.88	20482.65	19587.48	154164.0	86213.14
FER	10	36737.49	92810.98	25944.95	20882.87	19591.63	155632.5	85737.70
FER	11	37326.90	93055.12	26399.95	21077.30	19391.72	158999.4	84297.10
FER	12	37839.82	93295.37	26845.18	21207.94	19093.50	163065.0	82317.08
FER	13	38155.84	92325.79	27197.78	21251.50	18733.95	167054.7	80212.99
FER	14	38403.67	92440.36	27468.98	21241.14	18371.26	170216.4	78132.67
FER	15	38561.53	91626.39	27695.82	21288.46	18140.63	173320.1	76784.81
FER	16	38699.65	91606.52	27877.90	21250.85	17812.64	175814.0	74981.98
FER	17	38746.86	90903.31	28011.51	21221.27	17552.96	177724.7	73359.50
FER	18	38808.82	90812.75	28112.79	21148.72	17350.71	179379.3	72223.24
FER	19	38870.84	90525.51	28191.74	21176.12	17134.77	180447.2	71179.81
FER	20	38925.82	90341.79	28241.25	21129.49	17005.75	181615.3	70475.14
FER	21	38975.66	90552.33	28300.54	21120.72	16834.17	182650.8	69488.61
FER	22	38977.04	90161.67	28360.21	21151.05	16825.50	183281.9	69450.10
FER	23	39013.89	90161.31	28392.62	21158.57	16778.58	183728.3	69165.32
FER	24	39083.96	90145.69	28418.78	21127.82	16772.31	183868.6	69049.24
FER	25	39100.60	89937.31	28457.47	21160.46	16796.92	184123.3	69204.57
FER	26	39098.34	89879.62	28462.26	21157.64	16774.48	184221.8	69113.19
FER	27	39106.00	89924.65	28466.94	21150.26	16705.22	184535.9	68725.34
FER	28	39093.59	89695.87	28491.17	21133.98	16689.04	184831.1	68576.33
FER	29	39074.61	89441.80	28488.04	21105.32	16699.10	185174.6	68615.51
FER	30	39064.75	89146.55	28487.25	21098.44	16669.54	185039.0	68496.13
FER	31	39063.34	89272.97	28472.51	21083.76	16606.31	184783.4	68194.79
FER	32	39033.16	89592.63	28463.78	21096.95	16522.46	184592.4	67740.34
FER	33	39052.77	89789.09	28480.64	21044.71	16510.63	184543.8	67605.17
FER	34	39070.33	89889.26	28484.94	21049.16	16493.41	184787.5	67595.26
FER	35	39063.89	89806.18	28495.37	21069.20	16523.47	184952.1	67677.41
FER	36	39117.87	90017.82	28488.53	21066.71	16510.76	184961.4	67669.0[illegible]
FER	37	39145.46	90015.81	28509.71	21116.22	16650.65	184916.0	68380.36
FER	38	39137.21	89549.77	28534.67	21191.62	16760.04	184672.9	68976.45
FER	39	39155.72	89418.00	28530.44	21217.14	16803.25	184626.9	69167.45
FER	40	39090.71	89363.67	28492.68	21107.98	16685.60	184818.6	68491.03

		P-AGRICULTURE	P-TRANS/COMM	P-TRADE/SER	P-MIL PROD	P-R. ESTATE	C OF LEISURE	CRF-METALS
FER	1	67193.60	10692.44	160454.5	11014.15	80352.73	516445.1	0.1493178
FER	2	72592.31	14053.13	223323.2	18715.46	79769.69	457230.7	0.6382829
FER	3	80214.72	16546.20	245768.2	23323.72	76367.47	408250.4	1.959322
FER	4	84721.90	17961.05	249376.4	26173.06	73059.03	397706.1	3.537216
FER	5	90322.25	20438.84	249145.7	27666.25	69857.29	387229.7	4.402802
FER	6	94094.31	23001.88	249968.6	28623.88	66804.27	377378.7	5.005391
FER	7	97331.54	25274.09	255954.0	29843.28	64772.76	369493.9	5.671674
FER	8	98216.14	27061.44	265184.6	31053.03	65442.09	362733.0	6.092851
FER	9	98428.37	28148.02	275477.2	32328.87	69156.61	358841.2	7.096066
FER	10	99029.62	28749.03	284678.3	33398.03	74482.04	356145.4	7.746940
FER	11	101198.0	29022.48	292894.5	34304.30	79620.46	354073.0	8.163073
FER	12	103969.6	29202.78	299589.9	35046.81	84042.67	352237.9	8.576592
FER	13	106553.4	29246.26	305549.1	35742.77	87885.80	350991.1	9.087361
FER	14	108774.5	29316.55	310147.5	36255.55	91155.73	349886.1	9.331708
FER	15	110722.7	29362.34	313510.0	36628.40	93944.44	349167.3	9.556566
FER	16	112400.3	29355.32	316604.4	36942.84	96237.20	348380.8	9.669390
FER	17	113709.0	29298.71	319342.4	37205.69	98093.81	348060.5	9.862101
FER	18	114779.9	29287.10	321147.8	37426.30	99504.99	347745.7	9.836752
FER	19	115629.1	29262.48	322619.6	37501.22	100627.8	347471.0	9.866677

FEB 20	116319.7	29209.60	323543.1	37742.44	101486.1	347389.7	9.933009
FEB 21	116898.9	29215.20	324439.1	37832.00	102135.0	347321.1	10.00014
FEB 22	117356.8	29231.59	325293.7	37908.57	102596.3	346933.3	10.06357
FEB 23	117541.6	29238.20	325608.8	37920.43	102910.6	347063.8	10.12745
FEB 24	117661.1	29262.72	326310.8	37942.98	103190.7	346818.2	10.18615
FEB 25	117942.1	29302.29	326419.4	38008.40	103464.8	346662.0	10.21651
FEB 26	118096.1	29277.85	326704.6	38044.23	103756.8	346559.9	10.19305
FEB 27	118199.9	29249.68	327039.8	38070.79	104019.7	346575.8	10.15077
FEB 28	118264.9	29226.63	327413.1	38107.21	104200.1	346561.7	10.17293
FEB 29	118450.8	29230.28	327637.9	38122.33	104314.7	346451.4	10.16793
FEB 30	118541.0	29203.38	327583.6	38127.79	104470.4	346654.6	10.18086
FEB 31	118433.6	29182.62	327855.8	38132.85	104699.1	346561.6	10.21306
FEB 32	118331.1	29163.59	327762.3	38123.98	104880.8	346736.6	10.18021
FEB 33	118380.3	29156.96	327888.5	38155.24	104844.3	346671.9	10.12644
FEB 34	118367.5	29166.76	327827.9	38202.93	104720.2	346709.7	10.14910
FEB 35	118508.2	29186.73	327703.0	38144.30	104609.5	346658.7	10.23376
FEB 36	118480.9	29183.60	327631.7	38156.81	104468.8	346708.3	10.26265
FEB 37	118395.6	29251.29	327425.3	38145.27	104375.6	346548.3	10.30743
FEB 38	118371.4	29301.62	327495.2	38120.58	104423.2	346407.4	10.31086
FEB 39	118348.7	29310.11	327623.4	38142.12	104584.1	346278.5	10.25338
FEB 40	118351.0	29246.64	328018.9	38144.52	104799.7	346569.6	10.21836

	CBP-ENERGY	CBP-MACH BLDG	CBP-CHEMICALS	CBP-WOOD PROD	CBP-CNSTR MAT	CBP-POP SUPEFOR	CBP-AGRICULTURE
FEB 1	2363.275	433.1211	197.3434	355.9379	63.93979	50477.69	13289.63
FEB 2	2970.420	1248.608	152.1903	398.0549	167.0428	52723.20	14304.54
FEB 3	1839.553	1792.479	502.2617	1054.654	261.2587	56568.46	18544.47
FEB 4	1325.761	2435.232	832.4548	1749.163	288.5176	62293.13	19566.17
FEB 5	1280.099	3016.181	997.3441	2072.450	280.5516	70909.99	19785.01
FEB 6	1519.775	3488.447	1188.595	2175.951	259.1243	77532.46	19608.30
FEB 7	1866.991	3966.974	1365.437	2460.175	279.9170	82824.35	19158.38
FEB 8	2096.644	4265.905	1503.861	2773.035	306.8631	84675.82	18435.86
FEB 9	2363.753	4619.268	1652.910	2976.363	337.3756	85455.97	17557.77
FEB 10	2526.929	4807.107	1749.870	3124.735	358.6800	86254.24	16921.88
FEB 11	2697.967	5045.823	1840.443	3292.987	379.7363	88021.75	16908.07
FEB 12	2883.113	5202.848	1921.601	3399.653	395.3424	90107.11	17153.63
FEB 13	3038.234	5418.936	2012.790	3507.025	411.2861	92153.59	17517.00
FEB 14	3123.098	5518.552	2067.801	3579.225	423.7364	93745.05	17719.70
FEB 15	3203.733	5637.281	2107.674	3628.801	429.3708	95548.15	17961.10
FEB 16	3266.239	5685.824	2147.447	3681.139	436.6431	96846.66	18140.91
FEB 17	3317.421	5768.346	2184.155	3718.760	442.5823	97704.86	18305.59
FEB 18	3357.322	5806.831	2210.340	3760.888	445.2473	98599.41	18451.84
FEB 19	3412.541	5852.063	2231.828	3781.944	449.0328	99185.31	18606.86
FEB 20	3448.762	5875.044	2247.102	3796.900	450.5819	99835.75	18732.67
FEB 21	3469.262	5890.475	2261.525	3832.214	454.4643	100384.8	18728.76
FEB 22	3469.037	5928.697	2268.865	3847.548	454.6400	100670.7	18771.98
FEB 23	3508.090	5945.340	2273.888	3847.148	457.1929	100981.2	18846.05
FEB 24	3542.271	5956.641	2288.148	3860.551	459.7335	100986.6	18834.57
FEB 25	3538.838	5966.418	2292.985	3853.524	460.7149	101080.4	18856.02
FEB 26	3539.787	5974.961	2289.230	3853.680	460.9905	101227.6	18897.36
FEB 27	3548.298	5971.081	2294.301	3859.195	461.7221	101354.2	18919.84
FEB 28	3555.864	5968.274	2301.427	3866.755	462.8336	101493.6	18937.98
FEB 29	3542.235	5966.308	2304.970	3867.706	461.0540	101517.7	18924.31
FEB 30	3562.196	5983.920	2311.082	3866.619	460.2690	101507.4	18922.48
FEB 31	3574.721	5987.778	2315.298	3870.179	460.4045	101514.8	18926.49
FEB 32	3552.744	5973.906	2307.874	3869.257	460.9687	101368.9	18911.09
FEB 33	3562.580	5972.863	2313.553	3879.309	460.2351	101332.6	18864.21
FEB 34	3562.017	5976.622	2320.887	3872.695	460.4697	101491.1	18881.07
FEB 35	3557.576	5984.444	2314.247	3865.787	460.2701	101473.9	18932.73
FEB 36	3579.989	5980.431	2310.614	3878.687	462.9797	101547.1	18950.53
FEB 37	3568.091	5981.999	2315.426	3869.747	463.1333	101525.0	18925.14
FEB 38	3556.716	5994.127	2323.221	3876.374	462.7573	101421.8	18913.19
FEB 39	3565.977	5980.322	2315.106	3877.691	461.9710	101364.8	18896.68
FEB 40	3557.172	5985.742	2312.113	3885.729	463.6403	101607.6	18892.46

	CBP-TRANS/COMM	CBP-TRADE/SER	CBP-MIL PROD	CBP-R. ESTATE	C BY MILITARY	C BY FED GOV'T	C BY LOC GOV'T
FEB 1	1086.292	64857.10	55.19976	5979.05	27967.51	47286.05	26180.20

FER	2	1801.136	81938.38	96.11132	52017.90	49810.74	62260.90	45651.61
FER	3	797.7061	82703.83	118.1919	46727.22	63381.40	65795.24	55799.67
FER	4	792.1809	79829.82	149.5228	43580.44	72433.93	65132.08	56451.08
FER	5	1162.746	75799.58	161.9096	41007.32	77036.34	63128.09	57465.05
FER	6	1439.630	72862.45	172.0630	38343.48	79817.95	61120.51	58592.08
FER	7	1654.085	73968.13	180.6901	35993.25	83901.60	60861.17	60877.59
FER	8	1769.212	76512.31	185.9557	35702.12	87438.13	62146.69	63521.21
FER	9	1985.278	79080.72	191.0035	38105.66	91204.66	65053.80	66428.25
FER	10	2172.959	81374.13	194.9986	42059.10	94043.84	68554.79	68790.67
FER	11	2287.938	83202.82	198.9063	45912.85	96626.90	71635.47	70731.35
FER	12	2400.797	84798.53	201.7582	49202.59	98708.75	74179.05	72383.10
FER	13	2510.608	86080.53	204.5802	52104.38	100710.7	76324.06	73825.50
FER	14	2584.549	87104.35	205.8422	54634.67	101968.6	78046.99	74880.72
FER	15	2659.514	88019.70	207.4669	56913.34	103217.8	79569.68	75768.74
FER	16	2714.027	88613.31	208.5545	58686.74	103997.0	80661.85	76427.77
FER	17	2757.923	89185.53	209.5670	60163.33	104800.5	81614.68	77059.73
FER	18	2789.588	89728.27	210.2045	61250.50	105407.0	82368.90	77528.12
FER	19	2810.276	90056.05	210.7911	62065.60	105864.3	82893.28	77871.07
FER	20	2822.230	90301.07	211.2293	62759.84	106181.6	83309.79	78100.74
FER	21	2858.036	90524.00	211.5981	63248.08	106474.4	83643.73	78373.60
FER	22	2881.456	90616.94	211.8195	63681.21	106681.5	83868.56	78477.79
FER	23	2892.995	90802.15	212.0493	63894.32	106902.2	84072.94	78688.54
FER	24	2916.330	90832.84	212.1431	64169.43	107000.4	84201.07	78788.65
FER	25	2914.367	90890.95	212.3869	64362.84	107094.2	84309.18	78829.87
FER	26	2911.021	90917.43	212.4825	64594.14	107142.4	84409.60	78864.79
FER	27	2910.993	91015.43	212.4827	64906.50	107212.2	84581.22	78977.90
FER	28	2913.212	91113.70	212.5658	64927.42	107294.6	84652.23	79058.39
FER	29	2908.123	91195.20	212.5672	64960.13	107337.7	84707.51	79068.16
FER	30	2914.881	91249.13	212.6838	65128.50	107438.4	84802.73	79104.80
FER	31	2921.819	91202.01	212.7871	65430.11	107442.7	84882.27	79103.38
FER	32	2926.262	91210.17	212.7523	65651.85	107404.7	84957.42	79115.73
FER	33	2929.874	91234.70	212.7510	65539.88	107422.7	84931.53	79100.31
FER	34	2929.590	91248.45	212.8244	65514.67	107459.9	84937.69	79130.41
FER	35	2918.276	91178.66	212.7439	65322.02	107406.9	84829.08	79079.48
FER	36	2924.771	91193.58	212.7009	65171.61	107415.5	84793.48	79149.01
FER	37	2921.297	91163.87	212.6995	65055.45	107395.5	84733.93	79104.65
FER	38	2933.637	91086.11	212.7208	65109.43	107387.0	84712.38	79089.47
FER	39	2937.553	91094.33	212.5046	65337.60	107331.1	84784.24	79070.61
FER	40	2937.936	91337.30	212.9599	65512.82	107560.2	85000.45	79236.45

		EXPORTS
FER	1	-5546.577
FER	2	-8059.942
FER	3	-11395.31
FER	4	-13163.71
FER	5	-14743.12
FER	6	-16063.21
FER	7	-16543.40
FER	8	-16938.24
FER	9	-17421.73
FER	10	-17929.42
FER	11	-18034.62
FER	12	-18135.64
FER	13	-18039.39
FER	14	-18093.89
FER	15	-18002.34
FER	16	-18023.50
FER	17	-17934.53
FER	18	-17933.74
FER	19	-17901.54
FER	20	-17880.95
FER	21	-17930.44
FER	22	-17868.91
FER	23	-17873.57
FER	24	-17876.01
FER	25	-17849.03

FER 26	17841.56
FER 27	17849.10
FER 28	17817.17
FER 29	-17770.16
FER 30	17733.62
FER 31	-17750.75
FER 32	17795.77
FER 33	-17820.32
FER 34	-17844.30
FER 35	-17832.97
FER 36	-17865.37
FER 37	17868.47
FER 38	-17801.73
FER 39	-17782.21
FER 40	-17767.47

LISTING OF ARRAY SHADOW VAL T=0:

K1 METALS	K1-ENERGY	K1-MACH BLDG	K1-CHEMICALS	K1-WOOD PROD	K1-CNSTR MAT	K1-POF SUPPORT	K1-CONSTRUCTION
40.29324	1.760794	2.915018	14.72885	19.94475	0.9982331	2.391352	1.613506

K1 AGRICULTURE	K1-TRANS/COMM	K1-TRADE/SER	K1-MIL PROD	K1-R. ESTATE
0.6931778	3.059422	1.314283	4.245614	1.413736

LISTING OF ARRAY SHADOW VALUE:

	K1-METALS	K1-ENERGY	K1-MACH BLDG	K1-CHEMICALS	K1-WOOD PROD	K1-CNSTR MAT	K1-POF SUPPORT
FER 1	9.641700	2.055558	3.540085	9.469913	10.47888	1.201736	2.969617
FER 2	3.632661	2.247988	3.383217	3.634356	3.834554	1.413231	3.038299
FER 3	2.357656	2.195917	2.541117	2.501052	2.515344	1.618826	2.491089
FER 4	1.977317	1.943936	1.998459	2.050480	2.167924	1.758078	2.007953
FER 5	1.738185	1.664158	1.674015	1.743512	1.871439	1.709659	1.696089
FER 6	1.540540	1.467848	1.474463	1.540494	1.576531	1.531843	1.500283
FER 7	1.365180	1.337837	1.351277	1.395385	1.386527	1.374347	1.375419
FER 8	1.238789	1.243915	1.263411	1.291506	1.274590	1.261979	1.276840
FER 9	1.149789	1.174018	1.189667	1.215114	1.188169	1.178894	1.200367
FER 10	1.093548	1.116961	1.126368	1.153164	1.124754	1.116997	1.145295
FER 11	1.047836	1.074328	1.077914	1.102802	1.081452	1.071976	1.103605
FER 12	1.016681	1.044812	1.039974	1.064466	1.048085	1.037623	1.067388
FER 13	0.9988292	1.023040	1.012918	1.037435	1.023772	1.014733	1.034246
FER 14	0.9871838	1.005319	0.9920356	1.015233	1.003987	0.9978682	1.009914
FER 15	0.9791525	0.9908475	0.9755847	0.9960210	0.9868224	0.9832604	0.9940414
FER 16	0.9750649	0.9787900	0.9614166	0.9813804	0.9731160	0.9730925	0.9821271
FER 17	0.9727947	0.9684575	0.9513307	0.9706903	0.9628584	0.9649859	0.9726381
FER 18	0.9671518	0.9602655	0.9443093	0.9626749	0.9553191	0.9580521	0.9635455
FER 19	0.9608144	0.9546262	0.9396369	0.9566892	0.9482164	0.9521278	0.9532508
FER 20	0.9555338	0.9502783	0.9348819	0.9523721	0.9437807	0.9475569	0.9468737
FER 21	0.9516311	0.9456033	0.9310943	0.9487793	0.9430070	0.9436080	0.9447092
FER 22	0.9493576	0.9414929	0.9294047	0.9446667	0.9425249	0.9394177	0.9436027
FER 23	0.9485473	0.9397257	0.9278141	0.9409838	0.9419076	0.9368563	0.9429250
FER 24	0.9494042	0.9388847	0.9262788	0.9387092	0.9412800	0.9356940	0.9417521
FER 25	0.9508857	0.9377910	0.9258996	0.9359986	0.9394220	0.9353684	0.9404135
FER 26	0.9507824	0.9368691	0.9263667	0.9324834	0.9375083	0.9360687	0.9387383
FER 27	0.9495520	0.9363773	0.9261796	0.9295721	0.9363536	0.9380670	0.9372451
FER 28	0.9485866	0.9355599	0.9252824	0.9276116	0.9361387	0.9398155	0.9370004
FER 29	0.9475736	0.9347975	0.9253694	0.9266615	0.9358370	0.9398445	0.9379401
FER 30	0.9468881	0.9352001	0.9266326	0.9265602	0.9350100	0.9386528	0.9389701
FER 31	0.9460193	0.9352473	0.9271712	0.9259417	0.9340477	0.9375881	0.9382335
FER 32	0.9425270	0.9346855	0.9272434	0.9250625	0.9340634	0.9362971	0.9371854
FER 33	0.9368931	0.9343929	0.9276884	0.9259218	0.9344903	0.9341680	0.9379124
FER 34	0.9331103	0.9338959	0.9284914	0.9271679	0.9332946	0.9315279	0.9386055
FER 35	0.9316455	0.9340645	0.9289096	0.9266451	0.9323190	0.9298215	0.9377779
FER 36	0.9317464	0.9348090	0.9284118	0.9257007	0.9314888	0.9298672	0.9367921
FER 37	0.9335628	0.9346575	0.9285346	0.9266919	0.9299774	0.9297950	0.9353254

FER 38	0.9345784	0.9342607	0.9292340	0.9282995	0.9292166	0.9288700	0.9327423
FER 39	0.9338404	0.9337992	0.9300752	0.9284921	0.9293440	0.9285118	0.9313959
FER 40	0.9311913	0.9333725	0.9309654	0.9285505	0.9299871	0.9290319	0.9320186

	KI CONSTRUCTION	KI AGRICULTURE	KI TRANS/COMM	KI-TRADE/SER	KI MIL PROD	KI-R. ESTATE	LABOR
FER 1	2.212560	0.7629066	3.514630	1.514899	4.344663	1.488204	0.6756937
FER 2	2.691823	0.8379578	3.410927	1.648256	3.341219	1.525630	0.7632005
FER 3	2.512500	0.9172498	2.668872	1.707027	2.407973	1.535513	0.8547664
FER 4	2.117598	0.9983659	2.058669	1.692275	1.973650	1.525501	0.8774287
FER 5	1.748932	1.076706	1.755249	1.595611	1.664030	1.492735	0.9011672
FER 6	1.568390	1.144758	1.561318	1.457744	1.473186	1.431480	0.9246911
FER 7	1.419469	1.193315	1.409249	1.336760	1.351943	1.346191	0.9444235
FER 8	1.302172	1.210482	1.286832	1.245420	1.260855	1.256933	0.9620262
FER 9	1.216703	1.190515	1.203522	1.176109	1.184584	1.182092	0.9724600
FER 10	1.154040	1.148594	1.143021	1.122911	1.126514	1.125465	0.9798209
FER 11	1.105752	1.104393	1.094533	1.081564	1.084610	1.082602	0.9855558
FER 12	1.068740	1.066905	1.057353	1.049348	1.054215	1.049448	0.9906905
FER 13	1.039867	1.036381	1.028961	1.024035	1.029529	1.023857	0.9942096
FER 14	1.015874	1.010845	1.007032	1.004516	1.007739	1.004453	0.9973495
FER 15	0.9951830	0.9902982	0.9905557	0.9888632	0.9905984	0.9898218	0.9994025
FER 16	0.9813269	0.9738448	0.9780023	0.9763466	0.9785241	0.9788526	1.001659
FER 17	0.9724717	0.9608713	0.9682326	0.9672202	0.9692157	0.9706788	1.002581
FER 18	0.9646451	0.9516656	0.9597738	0.9606860	0.9614703	0.9643129	1.003488
FER 19	0.9576699	0.9464303	0.9515636	0.9556000	0.9559124	0.9592782	1.004282
FER 20	0.9522564	0.9424599	0.9448500	0.9517899	0.9524833	0.9553196	1.004517
FER 21	0.9470680	0.9383812	0.9407503	0.9487076	0.9493267	0.9521983	1.004715
FER 22	0.9417209	0.9358567	0.9380375	0.9461490	0.9457947	0.9495094	1.005838
FER 23	0.9390237	0.9340653	0.9368238	0.9440982	0.9422690	0.9470854	1.005460
FER 24	0.9363659	0.9322306	0.9367402	0.9421930	0.9399523	0.9450385	1.006172
FER 25	0.9327240	0.9314332	0.9362601	0.9403171	0.9391164	0.9432938	1.006625
FER 26	0.9313096	0.9315512	0.9353821	0.9385268	0.9382691	0.9420161	1.006922
FER 27	0.9326573	0.9321200	0.9344045	0.9373685	0.9374622	0.9409585	1.006876
FER 28	0.9335589	0.9328335	0.9330989	0.9371255	0.9371599	0.9397921	1.006917
FER 29	0.9334520	0.9333145	0.9315825	0.9376850	0.9373238	0.9388407	1.007237
FER 30	0.9328682	0.9336494	0.9304783	0.9379536	0.9373554	0.9384703	1.006647
FER 31	0.9328163	0.9336633	0.9298683	0.9376141	0.9369954	0.9387780	1.006917
FER 32	0.9323487	0.9326370	0.9297482	0.9374932	0.9369463	0.9393550	1.006409
FER 33	0.9308404	0.9308497	0.9298035	0.9376757	0.9370274	0.9398296	1.006596
FER 34	0.9294681	0.9301269	0.9291477	0.9376643	0.9367652	0.9400226	1.006487
FER 35	0.9287957	0.9306607	0.9279682	0.9372863	0.9358371	0.9396679	1.006635
FER 36	0.9283866	.9310841	0.9267306	0.9368789	0.9346737	0.9389013	1.006491
FER 37	0.9277161	9310747	0.9258808	0.9361073	0.9339520	0.9379432	1.006956
FER 38	0.9281045	0.9308240	0.9260530	0.9349420	0.9323918	0.9372157	1.007365
FER 39	0.9279804	[illegible]9599	0.9265262	0.9346612	0.9315258	0.9369904	1.007740
FER 40	0.9276048	[illegible]593	0.9268555	0.9350876	0.9321384	0.9369214	1.006894
	METALS	[illegible]	MACH BLDG	CHEMICALS	WOOD PROD	CNSTR MAT	POP SUPPORT
FER 1	61.52148	1.322440	12.75061	10.59064	10.08615	6.590497	1.883787
FER 2	14.39213	1.052138	4.422974	13.73275	9.018968	2.522676	1.803555
FER 3	4.688485	1.698940	3.080962	4.161161	3.404002	1.612941	1.680958
FER 4	2.597029	2.357357	2.267776	2.510637	2.052435	1.460552	1.526480
FER 5	2.086456	2.441444	1.830978	2.095557	1.732271	1.502023	1.340985
FER 6	1.835272	2.056417	1.583100	1.758372	1.649874	1.626227	1.226444
FER 7	1.619672	1.673972	1.392134	1.530639	1.459264	1.505428	1.148083
FER 8	1.507710	1.490616	1.294581	1.389751	1.294627	1.373234	1.122980
FER 9	1.294556	1.322173	1.195549	1.264432	1.206185	1.249038	1.112728
FER 10	1.185791	1.236794	1.148832	1.194370	1.148912	1.174849	1.102430
FER 11	1.125342	1.158387	1.094482	1.135592	1.090209	1.109704	1.080292
FER 12	1.071084	1.083999	1.061450	1.087631	1.056003	1.065899	1.055291
FER 13	1.010882	1.028654	1.019123	1.038356	1.023672	1.024579	1.031856
FER 14	0.9844127	1.000702	1.000726	1.010731	1.003023	0.9944744	1.014339
FER 15	0.9612503	0.9755153	0.9796496	0.9916108	0.9893199	0.9814243	0.9951968
FER 16	0.9500335	0.9568468	0.9712858	0.9732450	0.9752539	0.9650787	0.9818533
FER 17	0.9314701	0.9420846	0.9573906	0.9568883	0.9653874	0.9521279	0.9732291
FER 18	0.9338704	0.9308881	0.9510455	0.9455523	0.9545738	0.9464291	0.9643994
FER 19	0.9310381	0.9190052	0.9436946	0.9364485	0.9492590	0.9384502	0.9587026

FER 20	0.9248306	0.9062055	0.9100037	0.9300834	0.9455201	0.9352238	0.9524565
FER 21	0.9186125	0.9008518	0.9375407	0.9241515	0.9368071	0.9272344	0.9472470
FER 22	0.9128226	0.9009102	0.9314964	0.9211617	0.9330734	0.9268761	0.9445567
FER 23	0.9070643	0.8908811	0.9288888	0.9191971	0.9331704	0.9217006	0.9416530
FER 24	0.9018378	0.8832846	0.9271265	0.9133989	0.9299306	0.9166070	0.9416026
FER 25	0.8991573	0.8831403	0.9256073	0.9114721	0.9316263	0.9146545	0.9407288
FER 26	0.9012258	0.8829037	0.9242839	0.9129672	0.9315887	0.9141077	0.9393607
FER 27	0.9049807	0.8807859	0.9248845	0.9109493	0.9302575	0.9126594	0.9381869
FER 28	0.9030091	0.8789119	0.9253195	0.9081288	0.9284387	0.9104676	0.9368983
FER 29	0.9034531	0.8822935	0.9256244	0.9067328	0.9282103	0.9139818	0.9366765
FER 30	0.9023059	0.8773495	0.9229001	0.9043348	0.9284712	0.9155406	0.9367715
FER 31	0.8994612	0.8742755	0.9223054	0.9026880	0.9276173	0.9152712	0.9367034
FER 32	0.9023639	0.8796838	0.9244471	0.9055920	0.9278382	0.9141510	0.9380515
FER 33	0.9071555	0.8772548	0.9246085	0.9033688	0.9254340	0.9156080	0.9383868
FER 34	0.9051302	0.8773937	0.9240270	0.9005142	0.9270146	0.9151416	0.9369214
FER 35	0.8976415	0.8784889	0.9228192	0.9030981	0.9286710	0.9155384	0.9370801
FER 36	0.8951146	0.8729890	0.9234385	0.9045179	0.9255825	0.9101802	0.9364046
FER 37	0.8912260	0.8757036	0.9231964	0.9026380	0.9277208	0.9098784	0.9366085
FER 38	0.8909295	0.8787012	0.9213285	0.8996095	0.9261348	0.9106176	0.9375618
FER 39	0.8959241	0.8764193	0.9234553	0.9027629	0.9258201	0.9121677	0.9380891
FER 40	0.8989947	0.8785886	0.9226192	0.9039317	0.9239050	0.9088833	0.9358476

	CONSTRUCTION	AGRICULTURE	TRANS/COMM	TRADE/SER	MIL PROD	R. ESTATE
FER 1	6.309898	1.350495	1.391321	1.345105	3.732946	0.9243801
FER 2	2.675949	1.254677	1.457101	1.064698	2.143801	1.062619
FER 3	1.876932	0.9678129	3.289980	1.054844	1.743296	1.182934
FER 4	1.796021	0.9172756	3.312893	1.092820	1.378008	1.268349
FER 5	1.613955	0.9071299	2.257103	1.150925	1.272584	1.347935
FER 6	1.439641	0.9153048	1.822994	1.197319	1.197489	1.441580
FER 7	1.333799	0.9368002	1.586639	1.179422	1.140314	1.535710
FER 8	1.256123	0.9735143	1.483393	1.140204	1.108025	1.548233
FER 9	1.173708	1.022201	1.321949	1.103172	1.078742	1.450577
FER 10	1.119779	1.060614	1.207771	1.072080	1.056641	1.314227
FER 11	1.079659	1.061480	1.147075	1.048517	1.035882	1.203916
FER 12	1.049117	1.046285	1.093152	1.028787	1.021240	1.123421
FER 13	1.021389	1.024581	1.045339	1.013465	1.007152	1.060855
FER 14	1.003677	1.012860	1.015433	1.001553	1.000978	1.011724
FER 15	0.9913258	0.9992469	0.9868109	0.9911374	0.9931390	0.9712170
FER 16	0.9799048	0.9889064	0.9669899	0.9844978	0.9879600	0.9418686
FER 17	0.9688368	0.9804420	0.9515992	0.9781812	0.9831865	0.9187523
FER 18	0.9640922	0.9726711	0.9407974	0.9722645	0.9802051	0.9024448
FER 19	0.9590610	0.9645677	0.9338717	0.9687257	0.9774773	0.8905932
FER 20	0.9565867	0.9580896	0.9299160	0.9660972	0.9754496	0.8807415
FER 21	0.9512812	0.9582895	0.9182660	0.9637181	0.9737491	0.8739427
FER 22	0.9498909	0.9560833	0.9108025	0.9627296	0.9727315	0.8679986
FER 23	0.9460664	0.9523257	0.9071696	0.9607659	0.9716772	0.8651035
FER 24	0.9430846	0.9529060	0.8999108	0.9604413	0.9712479	0.8613946
FER 25	0.9429742	0.9510219	0.9005171	0.9598272	0.9701329	0.8588061
FER 26	0.9423431	0.9497399	0.9015520	0.9595477	0.9696963	0.8557309
FER 27	0.9401776	0.9486115	0.9015608	0.9585145	0.9696953	0.8516128
FER 28	0.9393957	0.9477027	0.9008739	0.9574807	0.9693163	0.8513384
FER 29	0.9410099	0.9483871	0.9024506	0.9566250	0.9693101	0.8509096
FER 30	0.9411712	0.9484789	0.9003581	0.9560596	0.9687786	0.8487099
FER 31	0.9403457	0.9482781	0.8982202	0.9565536	0.9683084	0.8447976
FER 32	0.9397607	0.9490503	0.8968565	0.9564681	0.9684666	0.8419443
FER 33	0.9411362	0.9514087	0.8957509	0.9562108	0.9684725	0.8433827
FER 34	0.9402792	0.9505591	0.8950378	0.9560667	0.9681384	0.8437072
FER 35	0.9405573	0.9479652	0.8993106	0.9567985	0.9685049	0.8461955
FER 36	0.9380069	0.9470748	0.8973138	0.9566420	0.9687008	0.8481485
FER 37	0.9390399	0.9483457	0.8983808	0.9569538	0.9687070	0.8496629
FER 38	0.9377598	0.9489451	0.8946017	0.9577707	0.9686100	0.8489584
FER 39	0.9388409	0.9497742	0.8934092	0.9576843	0.9695954	0.8459938
FER 40	0.9379847	0.9499862	0.8932928	0.9551367	0.9675224	0.8437310

LISTING OF ARRAY RENTAL VALUES

	KI METALS	KI ENERGY	KI MACH BLDG	KI CHEMICALS	KI WOOD PROD	KI CNSTR MAT	KI-POP SUPPORT
FFR 1	68.40275	0.1230710E 01	0.2933235E 01	6.450653	16.71850	0.6811147E-02	0.5272150
FFR 2	13.78692	0.5386223E 01	0.4111963	14.30492	16.11149	0.2238447E-01	0.9748257
FFR 3	3.772143	0.5430845	3.522278	3.110981	3.763070	0.8392974E-01	2.503398
FFR 4	1.192653	0.6425101	1.594302	1.393302	1.327147	0.1284275	2.250808
FFR 5	0.8559192	0.7302409	1.081565	1.071777	1.018932	0.3202503	1.681781
FFR 6	0.7110845	0.5921287	0.8143532	0.8167716	1.016214	0.5807383	1.321958
FFR 7	0.6130541	0.4498045	0.6256920	0.6704832	0.8072725	0.5499033	1.065677
FFR 8	0.5630097	0.3829945	0.5365877	0.5728090	0.6041765	0.4559632	0.9487221
FFR 9	0.4347995	0.3255528	0.4770461	0.4954270	0.5289039	0.3877452	0.8642967
FFR 10	0.3747529	0.2905327	0.4552421	0.4532845	0.4795539	0.3467260	0.7839641
FFR 11	0.3473710	0.2720870	0.4076720	0.4185143	0.4238058	0.3069558	0.7295014
FFR 12	0.3231957	0.2467871	0.3866833	0.3912809	0.3982089	0.2851745	0.6912651
FFR 13	0.2922832	0.2280995	0.3547660	0.3619739	0.3748912	0.2648946	0.6706983
FFR 14	0.2799721	0.2198095	0.3415744	0.3446258	0.3579160	0.2462643	0.6410256
FFR 15	0.2599789	0.2121948	0.3247602	0.3357764	0.3502242	0.2430285	0.6120540
FFR 16	0.2666538	0.2063388	0.3201924	0.3245175	0.3392784	0.2337478	0.5947737
FFR 17	0.2570728	0.2016746	0.3093466	0.3143798	0.3320507	0.2274984	0.5855142
FFR 18	0.2615496	0.1981718	0.3031420	0.3073790	0.3229680	0.2251487	0.5752409
FFR 19	0.2627647	0.1931992	0.2966141	0.3022856	0.3201156	0.2213778	0.5747994
FFR 20	0.2597773	0.1898146	0.2941242	0.2982309	0.3171282	0.2200915	0.5664760
FFR 21	0.2572327	0.1884478	0.2940896	0.2951425	0.3095496	0.2157804	0.5532350
FFR 22	0.2540613	0.1888888	0.2887689	0.2942029	0.3069104	0.2170507	0.5507089
FFR 23	0.2518095	0.1852915	0.2876026	0.2941168	0.3087627	0.2143002	0.5483051
FFR 24	0.2490334	0.1825071	0.2876022	0.2905251	0.3065844	0.2118341	0.5487955
FFR 25	0.2478835	0.1828413	0.2864223	0.2890141	0.3086969	0.2103212	0.5485679
FFR 26	0.2491385	0.1826797	0.2841246	0.2902614	0.3085968	0.2096334	0.5477412
FFR 27	0.2521002	0.1820425	0.2845895	0.2888860	0.3075320	0.2080150	0.5479103
FFR 28	0.2512155	0.1814383	0.2858575	0.2867750	0.3056998	0.2073229	0.5449978
FFR 29	0.2509323	0.1826036	0.2858941	0.2851131	0.3048804	0.2095768	0.5434786
FFR 30	0.2500174	0.1808772	0.2830083	0.2834221	0.3058751	0.2116365	0.5419950
FFR 31	0.2496450	0.1799442	0.2837066	0.2828001	0.3057011	0.2120161	0.5449037
FFR 32	0.2509977	0.1818964	0.2853940	0.2846378	0.3056278	0.2107565	0.5471737
FFR 33	0.2540567	0.1810921	0.2848702	0.2827095	0.3028195	0.2121413	0.5441059
FFR 34	0.2533267	0.1811642	0.2846704	0.2803662	0.3051518	0.2118152	0.5419939
FFR 35	0.2477482	0.1814078	0.2843774	0.2827467	0.3064274	0.2122797	0.5457521
FFR 36	0.2467448	0.1795026	0.2861266	0.2848795	0.3036099	0.2084903	0.5458420
FFR 37	0.2435505	0.1804145	0.2864793	0.2830429	0.3058585	0.2080826	0.5450460
FFR 38	0.2431546	0.1816516	0.2843247	0.2800987	0.3042132	0.2088122	0.5460214
FFR 39	0.2469208	0.1807649	0.2855735	0.2827321	0.3033553	0.2098201	0.5457568
FFR 40	0.2491175	0.1817150	0.2842725	0.2839991	0.3018013	0.2070353	0.5394320

	KI CONSTRUCTION	KI-AGRICULTURE	KI-TRANS/COMM	KI-TRADE/SER	KI-MIL PROD	KI R. ESTATE	LABOR
FFR 1	0.3005943E-01	0.1017697E-02	0.6035098E-01	0.5521930E-01	0.1143097	0.1326030	0.6756937
FFR 2	0.1380997	0.1874140E-02	0.2532244	0.1653796	1.886517	0.1894180	0.7632005
FFR 3	0.8655216	0.4731752E-02	1.444471	0.2965461	2.353805	0.2345348	0.8547664
FFR 4	1.747647	0.8825607E-02	1.471366	0.3858154	1.151333	0.2586582	0.8774287
FFR 5	1.569735	0.1745528E-01	0.8401142	0.4812884	0.9212902	0.2792780	0.9011672
FFR 6	1.012388	0.3112946E-01	0.6103743	0.5506698	0.6793107	0.3029593	0.9246911
FFR 7	0.8915812	0.5430032E-01	0.4967597	0.5154237	0.5290736	0.3278355	0.9444235
FFR 8	0.7891154	0.8420499E-01	0.4484424	0.4458229	0.4455345	0.3316979	0.9620262
FFR 9	0.6951602	0.1272922	0.3725823	0.3948661	0.4097274	0.3062288	0.9724600
FFR 10	0.6211020	0.1617606	0.3191959	0.3553957	0.3697198	0.2711670	0.9798209
FFR 11	0.5747830	0.1664287	0.2930372	0.3277078	0.3348342	0.2433232	0.9855558
FFR 12	0.5366372	0.1574170	0.2700144	0.3046865	0.3082026	0.2237202	0.9906905
FFR 13	0.5097377	0.1438416	0.2501941	0.2886598	0.2909553	0.2088302	0.9942096
FFR 14	0.4874672	0.1359294	0.2371241	0.2745023	0.2818681	0.1960976	0.9973495
FFR 15	0.4750517	0.1275991	0.2254064	0.2643031	0.2727735	0.1874047	0.9994025
FFR 16	0.4591306	0.1207498	0.2171461	0.2569879	0.2613898	0.1805130	1.001659
FFR 17	0.4424522	0.1152294	0.2107173	0.2500677	0.2541037	0.1748891	1.002581
FFR 18	0.4375682	0.1104339	0.2064115	0.2437521	0.2498979	0.1710609	1.003488
FFR 19	0.4324987	0.1050229	0.2041446	0.2403050	0.2463145	0.1684140	1.004282
FFR 20	0.4290463	0.1006312	0.2024933	0.2375461	0.2414978	0.1661561	1.004517
FFR 21	0.4228346	0.1015353	0.1975704	0.2351492	0.2393375	0.1644987	1.004715
FFR 22	0.4245605	0.9997983E-01	0.1944662	0.2342383	0.2393604	0.1630064	1.005838

FFR 23	0.4178501	0.9757303E-01	0.1931312	0.2324913	0.2304934	0.1625044	1.005460
FFR 24	0.4146296	0.9805976E-01	0.1901991	0.2319911	0.2375945	0.1616091	1.006172
FFR 25	0.4157237	0.9726386E-01	0.1904612	0.2311663	0.2341191	0.1609971	1.006625
FFR 26	0.4140992	0.9559097E-01	0.1909950	0.2310437	0.2335693	0.1602853	1.006922
FFR 27	0.4074295	0.9530057E-01	0.1910643	0.2300195	0.2337706	0.1594290	1.006076
FFR 28	0.4077040	0.9470754E-01	0.1908291	0.2288238	0.2330122	0.1594323	1.006917
FFR 29	0.4097121	0.9515066E-01	0.1913804	0.2275096	0.2323394	0.1592946	1.007237
FFR 30	0.4105003	0.9531271E-01	0.1906737	0.2270560	0.2319196	0.1585663	1.006647
FFR 31	0.4105511	0.9554273E-01	0.1899125	0.2285101	0.2327629	0.1577577	1.006917
FFR 32	0.4086917	0.9602850E-01	0.1892097	0.2283823	0.2326880	0.1570282	1.006409
FFR 33	0.4118473	0.9764940E-01	0.1886623	0.2278585	0.2319063	0.1573424	1.006596
FFR 34	0.4099997	0.9729605E-01	0.1888338	0.2277021	0.2324719	0.1574265	1.006487
FFR 35	0.4104518	0.9511524E-01	0.1902072	0.2284090	0.2326284	0.1581154	1.006635
FFR 36	0.4069553	0.9467409E-01	0.1895504	0.2284331	0.2337641	0.1586285	1.006491
FFR 37	0.4099110	0.9547213E-01	0.1898954	0.2282770	0.2325176	0.1588444	1.006956
FFR 38	0.4065554	0.9561185E-01	0.1881492	0.2290621	0.2323404	0.1587578	1.007365
FFR 39	0.4074998	0.9595678E-01	0.1874962	0.2286661	0.2339834	0.1580131	1.007740
FFR 40	0.4079242	0.9679742E-01	0.1876362	0.2265183	0.2298162	0.1574728	1.006894

LISTING OF ARRAY COST OF PRODCIN:

	K1 METALS	K1-ENERGY	K1-MACH BLDG	K1-CHEMICALS	K1-WOOD PROD	K1-CNSTR MAT	K1-FOR SUPPORT
FFR 1	9.651214	7.948739	9.286329	9.588198	10.23690	9.481953	9.366695
FFR 2	3.615649	3.133720	3.561100	3.636373	3.776793	3.592807	3.594000
FFR 3	2.523511	2.195408	2.462114	2.523595	2.641287	2.500737	2.483175
FFR 4	2.046125	1.919481	2.017373	2.045358	2.088924	2.034352	2.025001
FFR 5	1.726201	1.669119	1.712414	1.725450	1.743758	1.719580	1.715392
FFR 6	1.515334	1.476860	1.506821	1.515528	1.527647	1.511678	1.509466
FFR 7	1.364295	1.348763	1.360479	1.364663	1.368654	1.362536	1.361751
FFR 8	1.276092	1.265958	1.273263	1.276224	1.278900	1.274760	1.274041
FFR 9	1.185170	1.179354	1.183663	1.185354	1.186773	1.184483	1.184121
FFR 10	1.135171	1.127359	1.133515	1.135202	1.137750	1.134472	1.133989
FFR 11	1.087533	1.083542	1.086708	1.087590	1.088832	1.087181	1.086927
FFR 12	1.055686	1.052358	1.055026	1.055705	1.056819	1.055414	1.055197
FFR 13	1.020224	1.020816	1.020394	1.020317	1.019961	1.020293	1.020352
FFR 14	1.002152	1.002928	1.002357	1.002213	1.001864	1.002242	1.002303
FFR 15	0.9850582	0.9882269	0.9857309	0.9851473	0.9838410	0.9852982	0.9855328
FFR 16	0.9752802	0.9776200	0.9757688	0.9753123	0.9744192	0.9754589	0.9756208
FFR 17	0.9627648	0.9658407	0.9634331	0.9628263	0.9616656	0.9630339	0.9632580
FFR 18	0.9570665	0.9606222	0.9577735	0.9570856	0.9557629	0.9573206	0.9575479
FFR 19	0.9508053	0.9549847	0.9516361	0.9508385	0.9492739	0.9511103	0.9513808
FFR 20	0.9476540	0.9521757	0.9485255	0.9476813	0.9459835	0.9479669	0.9482524
FFR 21	0.9438620	0.9476487	0.9445742	0.9438395	0.9425116	0.9441148	0.9443352
FFR 22	0.9399431	0.9449766	0.9409082	0.9399363	0.9380994	0.9402768	0.9405851
FFR 23	0.9368249	0.9415022	0.9377493	0.9368341	0.9351350	0.9371614	0.9374633
FFR 24	0.9345159	0.9388539	0.9353881	0.9345083	0.9329815	0.9348420	0.9351196
FFR 25	0.9336553	0.9383723	0.9346043	0.9336668	0.9319673	0.9340116	0.9343210
FFR 26	0.9326743	0.9375695	0.9336658	0.9327020	0.9309230	0.9330515	0.9333795
FFR 27	0.9320237	0.9361551	0.9328672	0.9320390	0.9305807	0.9323581	0.9326330
FFR 28	0.9318797	0.9356886	0.9326427	0.9318754	0.9305579	0.9321811	0.9324242
FFR 29	0.9327369	0.9369265	0.9335454	0.9327240	0.9312418	0.9330375	0.9332938
FFR 30	0.9313300	0.9363108	0.9322961	0.9313335	0.9295194	0.9316810	0.9319944
FFR 31	0.9306431	0.9355548	0.9316024	0.9306444	0.9288720	0.9309929	0.9313067
FFR 32	0.9315284	0.9356956	0.9323552	0.9315137	0.9300496	0.9318373	0.9320992
FFR 33	0.9321885	0.9367155	0.9330550	0.9321515	0.9305532	0.9324919	0.9327596
FFR 34	0.9315063	0.9359459	0.9323602	0.9314797	0.9299091	0.9318150	0.9320833
FFR 35	0.9310265	0.9358517	0.9319722	0.9310316	0.9292894	0.9313796	0.9316852
FFR 36	0.9302167	0.9341644	0.9310043	0.9302041	0.9288466	0.9305248	0.9307714
FFR 37	0.9305584	0.9348549	0.9314100	0.9305567	0.9290436	0.9308884	0.9311602
FFR 38	0.9289865	0.9334321	0.9298836	0.9289877	0.9274357	0.9293418	0.9296258
FFR 39	0.9305864	0.9342666	0.9314212	0.9305653	0.9291237	0.9309047	0.9311651
FFR 40	0.9297102	0.9338989	0.9305335	0.9296827	0.9282277	0.9300130	0.9302697

	K1-CONSTRUCTION	K1-AGRICULTURE	K1-TRANS COMM	K1-TRADE/SER	K1-MIL PROD	K1-R. ESTATE
FFR 1	10.60205	[illegible]	[illegible]	[illegible]	[illegible]	6.530416

FFK	3	[illegible]	[illegible]	2.[illegible]51365	2.168865	2.375050	1.887815
FFK	4	2.123361	2.019284	2.088693	1.862940	1.968233	1.794391
FFK	5	1.753153	1.710217	1.742929	1.630139	1.684162	1.612265
FFK	6	1.556909	1.505699	1.522763	1.460306	1.488136	1.441905
FFK	7	1.370812	1.359058	1.369453	1.337904	1.349464	1.338041
FFK	8	1.280193	1.272641	1.279258	1.256242	1.265062	1.261617
FFK	9	1.187551	1.183055	1.187108	1.173913	1.178704	1.178752
FFK	10	1.139257	1.133312	1.137674	1.123924	1.129250	1.123613
FFK	11	1.089091	1.086467	1.088825	1.081237	1.084134	1.082030
FFK	12	1.057795	1.054920	1.056752	1.050871	1.053190	1.050602
FFK	13	1.019775	1.020105	1.020104	1.020377	1.020093	1.022008
FFK	14	1.001383	1.002187	1.001953	1.002884	1.002500	1.003753
FFK	15	0.9826797	0.9853275	0.9840865	0.9883248	0.9866456	0.9907360
FFK	16	0.9736181	0.9755957	0.9745385	0.9779765	0.9766668	0.9790795
FFK	17	0.9607407	0.9632535	0.9618300	0.9666073	0.9647713	0.9677617
FFK	18	0.9545185	0.9575853	0.9559139	0.9611302	0.9592489	0.9627735
FFK	19	0.9478333	0.9514175	0.9494666	0.9556200	0.9533577	0.9575810
FFK	20	0.9443737	0.9482996	0.9461940	0.9527242	0.9503345	0.9549512
FFK	21	0.9412105	0.9445145	0.9426058	0.9482912	0.9462935	0.9496853
FFK	22	0.9352870	0.9407154	0.9382708	0.9456463	0.9429667	0.9481194
FFK	23	0.9335378	0.9375956	0.9353000	0.9424678	0.9398389	0.9443454
FFK	24	0.9315580	0.9353147	0.9330963	0.9400334	0.9374855	0.9413849
FFK	25	0.9304052	0.9344703	0.9321326	0.9395572	0.9367723	0.9412016
FFK	26	0.9293299	0.9335153	0.9311100	0.9388273	0.9358944	0.9405160
FFK	27	0.9293282	0.9328277	0.9307089	0.9375235	0.9349778	0.9383784
FFK	28	0.9294019	0.9326549	0.9306516	0.9369726	0.9346711	0.9376284
FFK	29	0.9298395	0.9334929	0.9313635	0.9379129	0.9355940	0.9391697
FFK	30	0.9277824	0.9321324	0.9297081	0.9372457	0.9345273	0.9392277
FFK	31	0.9271973	0.9314703	0.9290467	0.9366013	0.9338322	0.9383578
FFK	32	0.9286677	0.9322933	0.9301632	0.9368137	0.9344238	0.9377918
FFK	33	0.9289371	0.9329559	0.9306694	0.9375496	0.9351405	0.9391344
FFK	34	0.9283590	0.9322780	0.9300365	0.9368974	0.9344518	0.9383075
FFK	35	0.9276585	0.9318453	0.9294650	0.9369260	0.9341835	0.9385970
FFK	36	0.9276362	0.9310198	0.9289341	0.9354490	0.9330906	0.9361989
FFK	37	0.9276762	0.9313714	0.9291729	0.9360934	0.9335519	0.9372118
FFK	38	0.9260743	0.9298611	0.9275619	0.9348571	0.9321154	0.9359369
FFK	39	0.9277893	0.9314065	0.9292163	0.9360398	0.9335665	0.9369636
FFK	40	0.9268303	0.9304937	0.9283208	0.9349926	0.9326264	0.9360767

LISTING OF ARRAY FRACTNL DIFFRNCE

		NI METALS	NI ENERGY	NI-MACH BLDG	NI-CHEMICALS	NI-WOOD PROD	NI-CNSTR MAT	NI-FOR SUPPORT
FFK	1	0.9868022E 03	2.866950	1.623194	0.1249060E 01	0.2309167E 01	6.890212	2.154176
FFK	2	0.4683232E 02	0.3940110	0.5257029E -01	0.5549873E -03	0.1506330E -01	1.542265	0.1828988
FFK	3	0.7034727E 01	0.2317639E 03	0.3108968E -01	0.9013316E -02	0.5006964E 01	0.5447841	-0.3177094E 02
FFK	4	0.3479875E 01	0.1258053E 01	0.9464428E -02	-0.2497606E 02	6.3644066E 01	0.1571454	0.8530045E 02
FFK	5	0.6894928E 02	0.2981194E 02	0.2293830E -01	-0.1035955E 01	-0.6822622E 01	0.5802912E -02	0.1138035E 01
FFK	6	0.1635199E 01	0.6139346E 02	0.2194579E -01	-0.1620630E 01	-0.3100779E -01	0.1316430E 01	0.6120919E 02
FFK	7	0.6481643E 03	0.8166863E 02	0.6809492E -02	-0.2201690E -01	0.1289021E -01	0.8594064E -02	0.9936905E 02
FFK	8	0.3849618E 01	0.1772018E 01	0.7797777E -02	0.1183287E 01	0.3381617E -02	0.1012755E -01	0.2192308E 02
FFK	9	0.3077178E 01	0.4544809E 02	0.5047095E -02	-0.2449189E -01	-0.1175293E -02	0.4740726E -02	0.1353383E 01
FFK	10	0.3806251E 01	0.9309080E 02	0.6345397E -02	-0.1557622E 01	0.1155459E -01	0.1564440E -01	-0.9871293E 02
FFK	11	0.3788475E 01	0.8576760E -02	0.8158624E -02	-0.1379367E -01	0.6824333E -02	0.1418425E 01	0.1511254E 01
FFK	12	0.3836550E 01	0.7222104E 02	0.1447309E -01	-0.8230725E -02	0.8333753E -02	0.1714635E -01	-0.1142088E 01
FFK	13	0.2142015E 01	0.2173097E 02	0.7380392E -02	-0.1649996E -01	-0.3723440E -02	0.5479299E -02	-0.1343379E 01
FFK	14	0.1516296E 01	0.2370611E 02	0.1040417E -01	-0.1282423E -01	-0.2114583E -02	0.4382745E -02	-0.7537056E 02
FFK	15	0.6031413E 02	0.2644844E 02	0.1040012E -01	-0.1091717E 01	-0.3021192E -02	0.2072440E 02	-0.8559589E 02
FFK	16	0.2207517E 03	0.1195279E 02	0.1492817E -01	-0.6183232E -02	0.1339268E -02	0.2431844E -02	-0.6624689E -02
FFK	17	0.1031047E 01	0.2702021E 02	0.1272154E 01	-0.8101488E 02	0.1238835E -02	0.2022851E -02	-0.9643987E 02
FFK	18	0.1042784E 01	0.3713786E 03	0.1425818E 01	0.5805947E -02	0.4646050E -03	0.7635497E -03	0.6224556E 02
FFK	19	0.1041729E 01	0.3755705E -03	0.1277003E -01	-0.6115651E -02	0.1115281E -02	0.1068569E -02	-0.1961723E 02
FFK	20	0.8246491E -02	0.1996665E 02	0.1459393E 01	-0.4925374E -02	0.2334026E -02	0.4327289E -03	0.1456094E 02
FFK	21	0.8163960E 02	0.2131366E 02	0.1447744E -01	-0.5206536E -02	-0.5253608E -03	0.5371068E -03	-0.3958620E -03
FFK	22	0.9916700E 0[illegible]	0.3700209E 02	0.1237726E -01	-0.5007492E -02	-0.4695378E -02	0.9144833E -03	-0.3198016E -02

FFK 23	[illegible] 01	0.1890[illegible] 0[illegible]	0.1070[illegible] 01	0.4409925E 02	0.7190326E 02	0.3257047E 03	0.5792248E 02
FFK 24	[illegible] 01	[illegible]	[illegible] 02	0.44[illegible] 0[illegible]	0.8816[illegible] 0[illegible]	0.9105103E -03	-0.7042723E -02
FFK 25	0.1811031E 01	0.5190945E 03	0.9301424E 0[illegible]	0.3491260E 02	-0.7935365E 02	0.1450547E -02	-0.6478521E 02
FFK 26	0.1904516E 01	0.7426114E 03	0.7879313E 02	0.2344118E 03	0.7024321E -02	-0.3223222E -02	-0.5708482E 02
FFK 27	0.1849942E 01	0.1373120E 03	0.7220618E 02	0.2653820E 02	0.6165287E 02	0.6085713E -02	0.4920986E 02
FFK 28	0.1261242E 01	0.1375422E 03	0.7954744E 02	0.4596564E -02	0.5961579E -02	-0.8123266E -02	-0.4883897E -02
FFK 29	0.1555762E 01	0.2277494E 02	0.8835414E -02	0.6542311E -02	-0.4910326E -02	-0.7242703E -02	-0.4953713E 02
FFK 30	0.1643086E 01	0.1187711E 02	0.6111866E 02	0.5151631E -02	-0.5872262E -02	0.7426698E -02	-0.7429171E -02
FFK 31	0.1625362E 01	0.3287745E 03	0.4779256E -02	0.5078824E -02	-0.5541170E -02	-0.7028857E -02	-0.7382720E -02
FFK 32	0.1136932E 01	0.1080666E 02	0.5512890E -02	0.6973804E -02	-0.4297058E -02	-0.4763301E -02	-0.5427092E -02
FFK 33	0.5021485E -02	0.2485709E 02	0.5784926E -02	0.6728104E -02	-0.4213078E -02	-0.1794158E -02	-0.5493918E -02
FFK 34	0.1719036E -02	0.2195151E -02	0.4166811E -02	0.4650450E -02	-0.3627511E -02	0.3082840E -03	-0.6948836E -02
FFK 35	0.6644176E -03	0.1913351E -02	0.3296998E -02	0.4733751E -02	-0.3249555E -02	0.1675749E -02	-0.6497031E -02
FFK 36	0.1641717E -02	-0.6895467E -03	0.2792383E -02	0.4864919E -02	-0.2836454E -02	0.7072653E -03	-0.6426880E -02
FFK 37	0.[illegible]4925E 02	0.2112196E -03	0.3096638E -02	0.4170593E -02	-0.1004106E -02	0.1175945E -02	-0.4453228E -02
FFK 38	[illegible]339E -02	-0.8069219E -03	0.6990797E -03	0.7413664E -03	-0.1916582E -02	0.5078734E -03	-0.3341179E -02
FFK 39	[illegible]262E -02	0.1035949E 02	0.1447234E 02	0.2232858E -02	-0.2369835E -03	0.2577146E -02	-0.2477885E -03
FFK 40	0.[illegible]70456E -02	0.5639587E 03	-0.4638419E -03	0.1219414E -02	-0.1891817E -02	0.1056094E -02	-0.1876462E -02

	K1 CONSTRUCTION	K1 AGRICULTURE	K1-TRANS/COMM	K1-TRADE/SER	K1-MIL PROD	K1 R. ESTATE
FFK 1	3.794378	11.24651	1.882925	3.961957	1.008751	3.253729
FFK 2	0.4533913	3.169856	0.1110564	0.9555909	0.3137894E -01	0.7579597
FFK 3	0.5211858E 01	1.691619	-0.1405345E -01	0.2705450	0.1325334E -01	0.2294357
FFK 4	0.2721463E 02	1.022509	0.1322408E -01	0.1008547	-0.2744950E -02	0.1762637
FFK 5	0.2413605E 02	0.5883789	0.7019105E -02	0.2163974E -01	0.1209781E -01	0.8007453E -01
FFK 6	0.2046733E 01	0.3152994	-0.2149180E -01	0.1757214E -02	0.1014832E -01	0.7282622E -02
FFK 7	0.3427830E 01	0.1308925	0.2823889E -01	0.8558166E -03	-0.1833207E -02	-0.6054800E -02
FFK 8	0.1687830E -01	0.5135076E -01	-0.5885212E -02	0.8688932E -02	0.3336211E -02	0.3726664E -02
FFK 9	0.2386911E -01	-0.6257909E -02	-0.1363896E -01	0.1867654E -02	-0.4964431E -02	0.2825479E -02
FFK 10	0.1237655E -01	0.1330458E 01	-0.4677719E -02	0.9015317E -03	0.2428495E -02	-0.1645137E -02
FFK 11	0.1434419E 01	0.1623148E -01	-0.5214485E -02	-0.3017118E -03	-0.4384029E -03	-0.5281465E -03
FFK 12	0.1024016E 01	-0.1123365E -01	-0.5681127E -03	0.1450812E -02	-0.9715303E -03	0.1099788E -02
FFK 13	0.1932164E -01	-0.1570525E -01	0.8607437E -02	0.3572257E -02	-0.9165349E -02	0.1805985E -02
FFK 14	0.1396930E -01	-0.8565852E -02	-0.5043254E -02	-0.1625276E -02	-0.5198392E -02	0.6979569E -03
FFK 15	0.1256381E -01	-0.5019412E 02	-0.6530915E -02	0.5445026E -03	-0.3990309E -02	0.9236017E 03
FFK 16	0.7855550E -02	0.1797911E -02	-0.3541615E -02	0.1669406E -02	-0.1898134E -02	0.2317944E 03
FFK 17	0.1206300E 01	0.2479228E 02	-0.6612633E -02	-0.5509941E -03	-0.4505577E -02	0.3005228E 02
FFK 18	0.1049701E 01	0.6220320E -02	-0.4021731E -02	0.4623739E -03	-0.2310425E -02	0.1596379E -02
FFK 19	0.1027145E -01	0.5269448E -02	0.2203729E -02	0.2090310E 04	-0.2672525E -02	0.1769291E -02
FFK 20	0.8277972E 02	0.6196221E -02	0.1422411E -02	0.9815488E -03	-0.2255950E -02	0.3856394E 03
FFK 21	0.6188875E 02	0.6536055E -02	0.1972314E -02	-0.4389501E -03	-0.3195121E -02	0.2639171E -02
FFK 22	0.5770160E -02	0.5191692E 02	0.2486869E -03	-0.5312546E -03	0.2970033E -02	0.1463877E -02
FFK 23	0.5842163E 02	0.3779550E 02	-0.1626584E -02	-0.1726911E -02	0.2579023E -02	0.2893051E 02
FFK 24	0.5123988E 02	0.3308343E 02	-0.3089900E -02	-0.2292087E -02	-0.2624291E -02	0.3866071E 02
FFK 25	0.2485987E 02	0.3260685E 02	0.4408524E -02	-0.8082025E -03	-0.2496151E 02	0.2217970E 02
FFK 26	0.2125726E 02	0.2108434E 02	0.4567149E -02	0.3201634E -03	-0.2530875E -02	-0.1592443E -02
FFK 27	0.3569492E 02	0.7591740E 03	-0.3955024E -02	0.1653426E -03	-0.2650193E 02	0.[illegible]41974E 02
FFK 28	-0.4452915E -02	-0.1914813E 03	-0.2622742E -02	0.1631594E 03	-0.2655683E 02	0.2302350E 02
FFK 29	0.3870039E 02	0.1911911E 03	-0.2351024E -03	0.2431151E 03	-0.1045444E -02	0.3504430E 03
FFK 30	0.5451236E 02	0.1624717E 02	0.4277824E -03	0.7547144E 03	-0.3017168E -02	0.8070620E -03
FFK 31	0.6023691E 02	0.2348801E 02	-0.8835477E -03	-0.1080215E 02	-0.3375861E -02	0.4476406E 03
FFK 32	0.3948098E 02	0.3685039E 03	0.4463305E -03	0.7247739E -03	-0.2692263E -02	0.1664135E -02
FFK 33	0.2044731E 02	0.2262725E 02	0.9311989E -03	-0.1344508E -03	-0.2013737E -02	0.7396597E 03
FFK 34	0.1193272E 02	0.2312713E 02	0.9565458E -03	-0.8178311E -03	0.2469560E 02	0.1824587E 02
FFK 35	0.1224354E 02	0.1272921E 02	0.1613026E -02	-0.3844820E 03	-0.1766963E -02	0.1139660E 02
FFK 36	0.8082440E 03	0.6900167E 04	0.2377764E -02	0.1526262E -02	0.1693714E -02	0.2878226E 02
FFK 37	0.4304670E 04	0.3187088E 03	0.3555656E -02	-0.1481986E -04	0.4284224E 03	-0.7798561E 03
FFK 38	0.2187479E 02	0.1034458E [illegible]2	0.1629404E 02	0.9081506E -04	-0.2964676E 03	0.1364518E 02
FFK 39	0.2059069E 03	0.1555556E [illegible]2	0.2903385E 02	0.1475016E -02	0.2190714E 02	0.2855423E 04
FFK 40	0.8349170E 03	0.1328367E -02	0.1580935E -02	-0.1016132E 03	0.5236053E -03	0.9016038E 03

LISTING OF ARRAY EVERETT EPSILON:

	K1 METALS	K1 ENERGY	K1 MACH BLDG	K1 CHEMICALS	K1 WOOD PROD	K1 CNSTR MAT	K1 FOR SUPPORT
FFK 1	0.[illegible]7169E 0[illegible]	0.0000000E 100	0.0000000E 100	0.[illegible]42[illegible]02E 03	0.6277169E 02	0.0000000E 100	0.0000000E 100

FEK 2	[illegible] 01	0.0000000E+00	0.6277169E 02	0.5942882E 03	0.4811375E-02	0.0000000E+00	0.0000000E+00
FEK 3	0.2040080E 01	0.6277169E 02	0.2040080E 01	0.6277169E 02	0.6630260E 01	0.0000000E+00	0.1931437E 02
FEK 4	0.2040080E 01	[illegible]	[illegible]	0.5626397E 04	0.2040080E 01	0.0000000E+00	0.5942882E 03
FEK 5	0.6630260E 01	0.1931437E 02	0.5626397E 04	0.6277169E 02	0.2040080E 01	0.1931437E-02	0.5942882E 03
FEK 6	0.6277169E 02	0.2040080E 01	0.2040080E 01	0.1828579E 03	0.2040080E 01	0.6277169E-02	0.5942882E 03
FEK 7	0.6277169E 02	0.1931437E 02	0.6277169E 02	0.1731199E-04	0.1931437E 02	0.6277169E-02	0.1931437E-02
FEK 8	0.2040080E 01	0.5626397E 04	0.5942882E 03	0.1931437E 02	0.5942882E 03	0.1931437E 02	0.6277169E 02
FEK 9	0.1931437E 02	0.1828579E 03	0.6277169E 02	0.1828579E 03	0.5626397E 04	0.1828579E-03	0.1731199E 04
FEK 10	0.1931437E 02	0.6277169E 02	0.5942882E 03	0.1731199E 04	0.6277169E 02	0.1931437E-02	0.1931437E 02
FEK 11	0.1931437E 02	0.5626397E 04	0.1828579E 03	0.1931437E 02	0.6277169E 02	0.1931437E 02	0.1931437E 02
FEK 12	0.1931437E 02	0.6277169E 02	0.2040080E 01	0.1931437E 02	-0.6277169E 02	0.1931437E 02	0.1828579E 03
FEK 13	0.1828579E 03	0.6277169E 02	0.1931437E 02	0.1731199E 04	0.6277169E 02	0.1931437E 02	0.1931437E 02
FEK 14	0.2040080E 01	0.1931437E-02	0.5942882E 03	0.1731199E-04	0.5942882E 03	0.1931437E-02	-0.6277169E-02
FEK 15	0.1931437E 02	0.1828579E 03	0.5942882E 03	0.1828579E-03	-0.5942882E 03	0.1931437E-02	0.1828579E 03
FEK 16	0.1931437E 02	0.1931437E 02	0.5626397E 04	0.1828579E-03	0.6277169E 02	0.1931437E-02	0.1931437E 02
FEK 17	0.2040080E-01	0.1828579E 03	0.5942882E-03	0.1731199E 04	-0.5942882E-03	0.1931437E-02	0.1828579E-03
FEK 18	0.1931437E 02	0.1931437E 02	0.5626397E 04	0.1828579E 03	0.5942882E-03	-0.1931437E-02	0.5942882E-03
FEK 19	0.1828579E 03	0.1639005E-05	-0.1828579E-03	0.1828579E-03	0.5942882E-03	0.6277169E-02	-0.6277169E-02
FEK 20	0.1931437E 02	0.5326766E-05	-0.1931437E-02	0.1828579E-03	0.1931437E 02	0.1931437E-02	-0.6277169E-02
FEK 21	0.1931437E 02	0.1828579E 03	0.1828579E-03	0.1731199E-04	-0.5942882E-03	-0.1931437E-02	0.5942882E-03
FEK 22	0.1931437E 02	-0.1931437E-02	0.1931437E-02	0.1828579E 03	0.5942882E-03	0.1828579E-03	-0.6277169E 02
FEK 23	0.5942882E 03	-0.1931437E 02	-0.1931437E-02	0.1731199E-04	0.5942882E-03	0.1731199E-04	0.5942882E 03
FEK 24	0.5942882E-03	0.1931437E 02	-0.1828579E-03	0.1828579E-03	0.1828579E-03	0.1731199E-04	0.1828579E 03
FEK 25	0.1828579E 03	0.1931437E 02	-0.1931437E-02	0.1931437E-02	0.1931437E-02	0.5626397E-04	0.6277169E 02
FEK 26	0.1828579E 03	0.1828579E-03	-0.6277169E-02	0.1731199E-04	0.1828579E-03	0.1828579E-03	0.5942882E 03
FEK 27	0.1828579E-03	0.1931437E-02	-0.5942882E 03	0.1731199E-04	0.1931437E-02	0.1731199E-04	-0.5942882E 03
FEK 28	0.1828579E-03	0.1931437E-02	-0.5942882E-03	0.1828579E-03	0.1931437E-02	0.1828579E-03	-0.5942882E 03
FEK 29	0.1731199E 04	0.1931437E 02	-0.5326766E-05	0.2040080E-01	0.1828579E-03	0.1931437E-02	0.1931437E-02
FEK 30	0.1931437E-02	-0.5626397E 04	-0.5326766E-05	-0.5942882E-03	0.1828579E-03	0.1828579E-03	0.1931437E 02
FEK 31	0.1828579E 03	-0.5942882E-03	-0.5942882E-03	-0.5942882E-03	0.1931437E 02	0.1828579E-03	0.1931437E-02
FEK 32	0.1931437E 02	-0.1931437E-02	-0.5942882E-03	-0.5942882E-03	0.1931437E-02	0.1828579E 03	0.1828579E 03
FEK 33	0.6277169E 02	-0.1931437E-02	-0.5626397E-04	-0.5626397E-04	0.1931437E 02	0.5942882E-03	0.1828579E 03
FEK 34	0.5942882E-03	-0.1731199E-04	-0.5942882E-03	-0.5626397E 04	0.1931437E-02	0.6277169E-02	0.1828579E 03
FEK 35	0.5942882E 03	-0.1828579E-03	-0.5942882E-03	-0.5626397E-04	0.1828579E-03	0.1828579E 03	0.1828579E 03
FEK 36	0.5942882E-03	-0.1931437E-02	-0.6277169E-02	-0.1931437E-02	0.1931437E-02	0.1828579E-03	0.1931437E 02
FEK 37	0.6277169E-02	-0.1931437E 02	-0.1828579E-03	-0.1931437E-02	0.5326766E-05	0.1828579E 03	0.1931437E 02
FEK 38	0.5942882E 03	0.1828579E 03	-0.5626397E-04	0.1931437E-02	0.1828579E-03	0.5942882E-03	0.1931437E 02
FEK 39	0.1931437E 02	-0.5626397E 04	-0.5626397E-04	-0.5942882E-03	0.1828579E-03	-0.5942882E-03	-0.5942882E 03
FEK 40	0.5942882E-03	-0.1931437E-02	0.5942882E-03	-0.1828579E-03	0.5626397E-04	-0.1931437E-02	0.5942882E 03

	K1-CONSTRUCTION	K1-AGRICULTURE	K1-TRANS/COMM	K1-TRADE/SER	K1-MIL PROD	K1-R. ESTATE
FEK 1	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00
FEK 2	0.0000000E+00	0.0000000E+00	0.0000000E+00	0.0000000E+00	-0.6277169E-02	0.0000000E+00
FEK 3	0.0000000E+00	0.0000000E+00	0.1931437E-02	0.0000000E+00	0.2040080E-01	0.0000000E+00
FEK 4	0.1931437E 02	0.0000000E+00	-0.6277169E-02	0.0000000E+00	0.1931437E-02	0.0000000E+00
FEK 5	0.1931437E 02	0.0000000E+00	0.1731199E-04	-0.6277169E 02	0.5942882E 03	0.0000000E+00
FEK 6	0.6277169E 02	0.0000000E+00	0.1931437E-02	0.2040080E-01	-0.6277169E-02	0.6630260E 01
FEK 7	0.5626397E 04	0.0000000E+00	0.1828579E 03	0.1931437E-02	0.5626397E-04	0.1931437E 02
FEK 8	0.6277169E 02	0.0000000E+00	0.1931437E-02	-0.5942882E 03	-0.5626397E-04	0.2040080E 01
FEK 9	0.6277169E 02	0.2040080E 01	0.1731199E-04	0.1731199E-04	-0.5942882E 03	0.1931437E 02
FEK 10	0.6277169E 02	0.1931437E 02	0.1828579E-03	-0.5626397E-04	0.5942882E-03	0.1931437E-02
FEK 11	0.5942882E 03	0.1931437E 02	0.1731199E-04	-0.5326767E-05	0.5942882E 03	0.5942882E-03
FEK 12	0.5942882E 03	0.1931437E-02	0.6277169E-02	-0.5626397E 04	-0.5626397E 04	0.5942882E 03
FEK 13	0.5942882E-03	0.1931437E 02	0.1731199E-04	-0.6277169E-02	0.1731199E-04	0.6277169E 02
FEK 14	0.5626397E 04	0.1931437E 02	0.2040080E-01	0.6277169E 02	-0.5326766E-05	0.6277169E-02
FEK 15	0.5942882E-03	0.1931437E 02	0.1639005E-05	0.5942882E 03	-0.5942882E-03	0.6277169E-02
FEK 16	0.5942882E 03	0.2040080E 01	0.1731199E-04	0.5626397E-04	-0.5626397E-04	0.1931437E-02
FEK 17	0.5626397E 04	0.1828579E 03	0.1731199E-04	-0.5326767E 05	0.5942882E-03	0.1931437E 02
FEK 18	0.6277169E 02	0.5942882E 03	0.1931437E-02	0.5942882E-03	-0.5942882E-03	0.1828579E 03
FEK 19	0.5942882E 03	0.5626397E 04	0.1731199E-04	0.1931437E-02	-0.5942882E-03	0.1931437E 02
FEK 20	0.5942882E 03	0.5626397E 04	0.1931437E 02	0.5942882E 03	0.5626397E 04	0.1828579E 03
FEK 21	0.5942882E 03	0.5942882E 03	0.5942882E 03	0.5942882E-03	0.1828579E 03	0.1931437E-02
FEK 22	0.5626397E 04	0.5626397E 04	0.1931437E 02	-0.5626397E-04	0.1828579E 03	0.1931437E 02
FEK 23	0.5626397E 04	0.5942882E 03	0.5626397E-04	0.1639005E-05	0.1731199E 04	0.1828579E-03
FEK 24	0.5626397E 04	0.6277169E 02	0.1731199E-04	0.1828579E-03	0.1731199E-04	0.1931437E 02
FEK 25	0.5942882E 03	0.6277169E 02	0.1828579E-03	0.1828579E 03	0.1828579E 03	0.1828579E 03

	0.5942882E 03	0.6277169E 02	0.1931437E 02	0.5626397E 04	0.1731199E 04	0.1931437E 02
FFR 27	[illegible] 03	0.1828579E 03	0.1828579E 03	0.1931437E 02	0.1639005E 05	0.1828579E 03
FFR 28	0.1828579E 03	0.1828579E 03	0.1828579E 03	0.1931437E 02	0.1731199E 04	0.1828579E 03
FFR 29	0.1731199E 04	0.1931437E 02	0.1828579E 03	0.1828579E 03	0.1828579E 03	0.1931437E 02
FFR 30	0.1931437E 02	0.1828579E 03	0.1931437E 02	0.1731199E 04	0.1639005E 05	0.5942882E 03
FFR 31	0.1731199E 04	0.1731199E 04	0.1931437E 02	0.1931437E 02	0.1931437E 02	0.1931437E 02
FFR 32	0.1828579E 03	0.1731199E 04	0.5942882E 03	0.1828579E 03	0.1731199E 04	0.1931437E 02
FFR 33	0.1931437E 02	0.1828579E 03	0.5942882E 03	0.1828579E 03	0.1828579E-03	0.1931437E-02
FFR 34	0.1731199E 04	0.1828579E 03	-0.5942882E-03	0.1828579E 03	0.1828579E 03	0.1931437E-02
FFR 35	0.5942882E 03	0.5626397E 04	0.5942882E-03	0.1931437E 02	0.1828579E-03	0.1828579E 03
FFR 36	0.6277169E 02	0.1931437E 02	-0.5942882E 03	0.1931437E-02	0.1828579E-03	0.1828579E-03
FFR 37	0.1931437E 02	0.6277169E 02	0.1828579E 03	0.1639005E-05	0.1931437E 02	0.5942882E-03
FFR 38	0.5942882E 03	0.1828579E 03	0.5626397E-04	0.1931437E 02	0.1931437E-02	0.1828579E-03
FFR 39	0.5942882E 03	0.5942882E 03	0.5942882E-03	-0.5942882E 03	0.5326767E-05	0.1731199E 04
FFR 40	0.6277169E 02	0.1828579E 03	0.1828579E-03	0.5942882E-03	0.5942882E-03	0.5942882E-03

LISTING OF ARRAY SUMMARY:

	STANDARD OF LIV	CONSUMPTION	INVESTMENT	GNP	TOTAL PRODUCTN	CAPITAL INVEN'Y
FFR 1	0.9776493	289663.9	12340.70	302004.6	508841.6	788253.4
FFR 2	0.9877615	357489.5	18375.98	375865.5	635023.6	778823.4
FFR 3	0.9892382	384493.1	37943.81	422436.9	725929.4	748510.5
FFR 4	0.9903379	393699.3	44960.52	438659.8	764264.0	732026.2
FFR 5	0.9906828	399363.9	58872.58	458236.5	813640.4	728614.0
FFR 6	0.9904075	402062.6	75603.67	477665.3	861038.6	734612.6
FFR 7	0.9910290	412821.0	86742.79	499563.8	906760.3	754105.4
FFR 8	0.9918141	424401.5	96119.36	520520.8	945433.0	785043.5
FFR 9	0.9933178	439598.2	98760.16	538358.3	974391.1	823604.1
FFR 10	0.9949001	455012.2	98799.36	553811.6	997716.2	865572.6
FFR 11	0.9964341	470756.6	95782.18	566538.7	1017705.	906448.3
FFR 12	0.9977396	484810.8	92713.47	577524.3	1035649.	943604.3
FFR 13	0.9989221	497788.9	88669.17	586458.0	1049700.	975802.0
FFR 14	0.9997787	507518.4	85709.72	593228.1	1061657.	1002832.
FFR 15	1.000601	516879.6	83071.41	599951.0	1071054.	1025058.
FFR 16	1.001152	523508.3	80759.67	604268.0	1078916.	1043417.
FFR 17	1.001652	529308.3	78172.80	607481.1	1084258.	1058432.
FFR 18	1.002053	533990.6	76459.63	610450.2	1088959.	1070306.
FFR 19	1.002334	537399.3	74883.62	612282.9	1092102.	1079501.
FFR 20	1.002578	540202.3	73833.35	614035.6	1094775.	1086641.
FFR 21	1.002778	542444.5	72951.12	615395.7	1097155.	1092146.
FFR 22	1.002872	543971.9	72379.78	616351.7	1099197.	1096434.
FFR 23	1.003019	545460.6	72047.51	617508.1	1100201.	1099783.
FFR 24	1.003059	546183.5	71774.11	617957.6	1101409.	1102513.
FFR 25	1.003098	546823.1	71672.94	618496.0	1102457.	1104795.
FFR 26	1.003144	547464.0	71548.00	619012.0	1103112.	1106778.
FFR 27	1.003227	548386.4	71172.19	619558.6	1103693.	1108550.
FFR 28	1.003274	548951.9	70722.26	619674.2	1104137.	1109994.
FFR 29	1.003283	549205.7	70449.77	619655.4	1104729.	1110971.
FFR 30	1.003346	549741.7	70129.13	619870.8	1104256.	1111560.
FFR 31	1.003368	550104.2	70016.68	620120.9	1104067.	1111850.
FFR 32	1.003390	550137.0	69877.68	620014.7	1103628.	1111942.
FFR 33	1.003370	549938.9	69752.64	619691.6	1103819.	1111924.
FFR 34	1.003396	550164.3	69862.86	620027.1	1104038.	1111773.
FFR 35	1.003351	549713.4	69880.95	619594.4	1104104.	1111613.
FFR 36	1.003360	549715.9	70075.71	619791.6	1104177.	1111511.
FFR 37	1.003315	549378.6	70750.34	620129.0	1104817.	1111492.
FFR 38	1.003287	549287.5	71026.71	620314.2	1104984.	1111070.
FFR 39	1.003286	549458.6	71159.13	620617.7	1105361.	1112665.
FFR 40	1.003428	550745.3	70269.56	621014.8	1104983.	1113636.

CPU TIME FOR THIS RUN - 3210.271 SECONDS

APPENDIX B

DATA AGGREGATOR--AGGRAT

The user will usually want to aggregate the economic data into sectors of interest. Perhaps he would like to keep the energy sectors separate, but combine many manufacturing sectors into one sector. This can most easily be accomplished through the use of the DSA data aggregator, AGGRAT, which also performs the task of calculating or asking for missing data such as depreciation rates, discount rates, etc., and putting the final data into model format.

B.1 DSA FORMAT

A primary data file must exist for AGGRAT to use. This file consists of a series of records, where each record contains four entries labeled I, J, K, and DATA. These four entries constitute the raw economic data in DSA format, as shown in Fig. B-1. The index K refers to "pages" 1-5. Indices I and J refer usually to industry number, and are the column and row indices for each page. The file must be sorted by K, J, and I.

B.1.1 PAGE 1 - PRODUCTION

The first page of the file is the production transactions matrix. If there are N production industries, this page consists of N columns and N + 6 rows. Index I refers to the production industry. Index J refers to the commodity used by industry I. DATA is the amount of commodity J used by industry I in the production of its product.

The indices I and J need not be integral. For example, the Bureau of Economic Analysis classifies the United States economy into 468 sectors, but only 86 primary industries. For this data base there are 468 values of I ranging for 1.0 to 86.9999 and 474 values of J.

Six values of J (0 to -5) are added to this page. These rows are defined as:

	K = 1 PRODUCTION	K = 2 INVESTMENT	K = 3 CONSUMPTION						K = 4 TRADE		K = 5 DOMESTIC TRANSFERS
	BY INDSUTRY I USES INDUSTRY J	FOR INDUSTRY I FROM INDUSTRY J	1 PERSONAL	2 MILITARY	3 FEDERAL GOVERNMENT	4 LOCAL GOVERNMENT	5 INVENTORY CHANGE	6 UNDIFFERENIATED	1 EXPORTS	2 IMPORTS	TO INDUSTRY I FROM INDUSTRY J
J = 0	UNDIFFERENTIATED	IMPORTS									
J = -1	WAGES										
J = -2	BURDEN										
J = -3	RENT (PTI)										
J = -4	CAPITAL INVENTORY										
J = -5	DEPRECIATION										

Figure B-1. Description of DSA Data Format

J	Interpretation
0	Undifferentiated Imports
-1	Wages to Labor
-2	Burden (Taxes)
-3	Rental on Capital (Property-Type Income)
-4	Capital Inventory
-5	Depreciation (Total)

The term "undifferentiated imports" refers to imports which have no domestic counterpart or which are consumed by final users in the form in which they are imported.

The sum of each column of page 1 down through J = -3 is the total output of that industry. It must equal the total use for that product, i.e., it must be equal to the sum of the corresponding row across pages 1-4. The data for J = -4 and J = -5 are not required. They are used only if the user wants the final aggregated data put into model format and even then are not required (see Sec. B.2).

B.1.2 PAGE 2 - INVESTMENT

The second page of the file is the investment, or capital formation page. The N values of I refer to the industry which uses the capital. The index J refers to the commodity required in the manufacture of the capital. No labor or capital is required in the manufacture of the capital since this matrix merely describes the mix of items comprising the capital for each industry. One extra row, J = 0 for undifferentiated imports, is provided.

B.1.3 PAGE 3 - CONSUMPTION

Consumption by final users is represented by page 3. There are six final users to which the data may be applied. The user may define these six in any way he wishes, but the aggregator normally assumes the following categories:

I	Final User
1	General Population
2	Military
3	Federal Government
4	Local Government
5	Inventory Change
6	Undifferentiated

If the user wishes to add more consuming sectors he will have to modify the model. In general, however, these six have been sufficient for all data bases used to date. The rows of page 3 are once again the industry codes plus J = 0 for undifferentiated imports.

B.1.4 PAGE 4 - TRADE

The trade matrix contains just two columns. I = 1 refers to exports while I = 2 refers to imports. The DATA value for J = 0, I = 2 must in this case equal the sum of the undifferentiated imports row, i.e., all of the undifferentiated imports are "imported" at I = 2, J = 0, K = 4.

B.1.5 PAGE 5 - DOMESTIC TRANSFERS

Some data bases have a quantity called domestic transfers. When a particular industry produces a completely secondary product, the secondary product is "sold" to the primary industry for that product, which distributes it. This fictitious transaction is called a domestic transfer. After the data is aggregated, the diagonal elements of this matrix must be subtracted from the diagonal elements of the production matrix, page 1, since these elements represent fictitious transactions between an aggregated industry and itself.

B.2 USING THE AGGREGATOR

The aggregator is primarily self-explanatory, i.e., the user need only answer the questions asked by the aggregator. The first question asked is:

HAS DATA BEEN AGGREGATED SUFFICIENTLY?

The aggregator has two uses: (1) to aggregate economic sectors, and (2) to put the aggregated data into model format. If the data were previously aggregated and put onto a file and the user just wants to use it in the model, or to change it slightly, he may answer yes. If the data are to be further aggregated, he should answer no.

The aggregator next asks the user for the name of the file which contains the data. If the data has been sufficiently aggregated, it is read in and the program informs the user how many industries are contained in the data. If it has not, the program needs more information. In particular, the user will be asked to supply the following:

1. The number of industries which will comprise the aggregated data base.
2. The industry codes which go into each aggregated sector.

No industry code can be in more than one sector. If this happens the aggregator will inform the user. The codes are input as a series of code ranges. An illustrative sequence is:

Example 1:

```
ECONOMIC MODEL DATA PREPARATION--HAS DATA BEEN AGGREGATED
SUFFICIENTLY? (Y OR N)

yes

INPUT FILE NAME

filename

BEGINNING TO READ IN DATA:
      FINISHED PAGE 1
      FINISHED PAGE 2
      FINISHED PAGE 3
      FINISHED PAGE 4
      FINISHED PAGE 5

DATA CONTAINS (number) PRODUCTION INDUSTRIES
```

Example 2:

ECONOMIC MODEL DATA PREPARATION--HAS DATA BEEN AGGREGATED SUFFICIENTLY? (Y OR N)

no

INPUT FILE NAME

filename

INPUT NUMBER OF RESOURCES (MAX OF 100)

10

DO YOU WISH DATA TO BE INTEGRALLY AGGREGATED (Y OR N)

"Y (ES)" WILL PUT DATA INTO INTEGRAL CODES 1-10 by INTEGERIZING ALL INDUSTRY CODES[1]

no

INPUT BEGINNING AND ENDING CODES FOR INDUSTRY 1

1   2.999

ANY OTHER SEGMENTS FOR INDUSTRY 1? (Y OR N)

yes

INPUT BEGINNING AND ENDING CODES FOR INDUSTRY 1

3   3.9999

ANY OTHER SEGMENTS FOR INDUSTRY 1? (Y OR N)

no

INPUT BEGINNING AND ENDING CODES FOR INDUSTRY 2

4.0   5.4001

ANY OTHER SEGMENTS FOR INDUSTRY 2? (Y OR N)

no

. . .

. . .

ANY OTHER SEGMENTS FOR INDUSTRY 10? (Y OR N)

no

---

[1] This is useful for data bases containing a large number of sectors divided into primary industries, such as the BEA US data base. Instead of the user having to input code ranges 1.0 - 1.9999, 2.0 - 2.999, etc., the model automatically sets the code ranges. This will aggregate the data into the primary industries which can be further aggregated later.

BEGINNING AGGREGATION:

FINISHED PAGE 1

FINISHED PAGE 2

FINISHED PAGE 3

FINISHED PAGE 4

FINISHED PAGE 5

After the aggregation, the user has the option of listing any of the aggregated data by page number, and of changing any data element. After the user is satisfied with the data, the program tests for consistency between row and column sums. If inconsistencies are found, the program informs the user of the problem industries and allows the user to look at and change the data before testing again. If the data is satisfactory, the user may copy it to a separate file. This aggregated data will have integral industry codes as opposed to the primary data base which need not have integral codes.

B.3 MODEL FORMAT

After aggregation, the user may decide to have the data put into model format. Assuming he answers the question

WOULD YOU LIKE DATA PUT INTO MODEL FORMAT? (Y OR N)

with "yes," the aggregator will inquire as to his preferences regarding the number of capital types, the names of consumables, the number and definition of consumption activities, and primary data arrays.

B.3.1 CAPITAL TYPES

The following question is asked:

CAPITAL MAY BE DIVIDED INTO TWO TYPES BY INDUSTRY GROUP IN ORDER TO DISTINGUISH TWO DEPRECIATION RATES (E.G., FOR STRUCTURES VS. EQUIPMENT) --DO YOU WISH THIS DIVISION? (Y OR N).

If the user answers with "yes," he will be asked to supply the aggregated industries contained in each type of capital. Some industries may use only one type of capital. The aggregator will determine if this

is so and delete any capital not required. As only two types of capital are allowed, the total number of capital items will be between N + 1 and 2N + 1 where N is the number of aggregated industries. Every industry must use at least one capital type. If an industry is found which does not use any capital, the model will inform the user and abort.

B.3.2 INDUSTRY NAMES

The user has the option of letting the aggregator provide names for the aggregated industries (IND 1, IND 2, etc.) or naming them himself. The industry name may not be greater than 15 characters.

B.3.3 CONSUMPTION ACTIVITIES

The user may break page 3 into a set of consumption activities in any way desired. The most general way to define a consumption activity is by giving the industries and consumer groups (see Sec. B.1.3) included in the activity:

```
    INPUT GROUP NUMBER WHICH IS INCLUDED IN CONSUMPTION ACTIVITY
    (number); "S" TO STOP
    1
    INPUT INDUSTRY NUMBER OR RANGE OF INDUSTRY NUMBERS INCLUDED IN
GROUP 1'S PARTICIPATION IN ACTIVITY (number)
    5
    ANY MORE INDUSTRIES FOR GROUP 1 IN CONSUMPTION ACTIVITY (number)?
    no
    ANY MORE GROUPS IN CONSUMPTION ACTIVITY (number)?
    no
    INPUT NAME FOR THIS ACTIVITY
```

Contiguous groups may be listed together. For example, if the above activity were to be total consumption of industry 5, the user could have specified groups 1-6 in the first question by typing in "1 6" or "1,6." It is not necessary to list each group separately.

Conversely, if the user would like to break out a single group or combination of groups for <u>each</u> of a list of industries, he may answer the second question as follows:

INPUT INDUSTRY NUMBER OR RANGE OF INDUSTRY NUMBERS INCLUDED IN GROUP 1'S PARTICIPATION IN ACTIVITY (number)

5 10 I

The "I" informs the model that industries 5 through 10 constitute six independent consumption activities by the same group or groups.

B.3.4 MODEL PARAMETERS

Besides the activity levels and direct requirements matrix, the economic model requires the following data:

(1) Capital inventory levels
(2) Capital depreciation rates
(3) Current level of inventory growth
(4) Current value trends (used in calculating the discount rates--not used directly)
(5) Discount rates
(6) Gestation times
(7) Population growth

The aggregator considers which of the above it can calculate and which it needs to ask for. For example, if rows -4 and -5 of page 1 contain data, then the total capital inventory and overall depreciation rate is known. If the industry contains only one type of capital, its inventory and depreciation is therefore also known. If two types of capital are used, the model will split the total inventory according to how the user wants to split the depreciation rates of the two types.

The aggregator will list the above data for the user, inserting default values where necessary (e.g., gestation times are defaulted to one year). It will then ask the user to change any of the data he wishes with the exception of capital inventory and activity levels. Some of the data, e.g., discount rates or inventory when two types of capital are used or when row -4 is blank, are listed as question marks. These data will be calculated by the aggregator after the user has specified the remaining parameters. Value trends are defaulted to the growth rate. If the growth rate is to be calculated, i.e., it is listed

as a question mark, the value trend will be listed as zero. The actual value used in the calculation of the discounts will be either the growth rate, which is calculated first, or the value input by the user.

After the user has changed the data as he wishes, the aggregator will calculate the remaining data (previously listed as "?") and will relist the updated data arrays. The data are then output onto file ECO.DAT for later use by the economic model.

AD-A100 897 DECISION-SCIENCE APPLICATIONS INC ARLINGTON VA F/G 5/3
THE DYNEVAL (DYNAMIC ECONOMIC VALUES) MODEL. VOLUME II. DOCUMEN--ETC(U)
MAY 81 G E PUGH, M T NUNENKAMP, J C KRUPP AC00C104

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APPENDIX C

GLOSSARY OF VARIABLES USED IN DSA ECONOMIC RECOVERY MODEL

ACON	=	Direct requirements matrix -- ACON(I,J) is the amount of commodity I used per unit of activity J
ACTLAB	=	Labels (names) for activities
ARENT	=	Amount spent on capital and labor per unit of activity for the production of consumables in the current economy (first NCAPM1 is amount spent on capital (each capital is used for only one activity specified in ITRADE); next NCON is amount spent on labor)
B	=	Exponent for utility and translog functions (first NCAPM1 for translog exponent of capital/capital trade-offs; next NCON for translog exponent of capital/labor trade-offs, next NCONAC for utility exponent)
CAPLAB	=	Labels (names) for capital resources
CONLAB	=	Labels (Names) for consumables
D	=	Depreciation for the NCAPM1 capital resources (D(NCAP) = population growth)
DISCNT	=	Discount rate for the NCAPM1 capital resources
DLAMB	=	Rental value for capital resources (each time period)
DTAU	=	Difference between TPER and TLAG (DTAU(J) = TPER*(1.0 - AMOD(TLAG(J)/TPER,1.0)))
EFFCAP	=	Effective capital inventory (used when two types of capital are used to make one consumable)
EFFCST	=	Effective cost of producing capital
EFFLAB	=	Labor used in production of particular consumable (not constant but varies with time period)
EPSO	=	Epsilon parameters used in Everett algorithm for phase two
FLAM	=	Shadow value (offset by one time period) (FLAM(K=1)) contains horizon DLAMB values for capital

FUDGE	=	Normalization coefficient for translog function (first NCAPM1 for capital/capital trade-offs; next NCON for capital/labor trade-offs)
GAMMA	=	Coefficient for utility and translog functions (first NCAPM1 for translog function of capital/capital trade-offs, next NCON for translog function of capital/labor trade-offs (if GAMMA .GT. 0 IT IS GK -- if .LT. 0 ABS(GAMMA) is GL, GK + GL = 1.0); next NCONAC are utility coefficients (activity = GAMMA/(cost**B0)))
GROWTH	=	Fractional growth of industries producing capital in current economy
ITRADE	=	Array stating for which industry capital J is used
K	=	General index for time period
NACT	=	Number of activities
NCAP	=	Number of capital resources (including labor) (NCAP must be .GT. NCON .AND. .LE. 2*NCON + 1)
NCAPM1	=	Number of capital resources (excluding labor) = NCAP - 1
NCON	=	Number of consumable resources
NCONAC	=	Number of consumption activities
NCST	=	Total number of resources = NCAP + NCON
NPER	=	Number of time periods
NPRDAC	=	Number of production activities = NCON + NCAP -1
PERLAB	=	Labels used when printing out arrays with time period indices
PRMLAM	=	Lambda prime - gross profit in the manufacture of commodity I which is distributed between capital ε labor
R	=	Resource level for capital
REQ	=	Equilibrium levels for capital

RFUT	=	Resource level one gestation time in the future if no investment activity occurs (used in phase one only)
RLAST	=	Resource level achieved in previous pass for given time period and capital item
RORGNL	=	Starting level of resources
RSCALE	=	Scaling factor used in phase one method of determining investment activity levels
RTRGT	=	Target resource level for one gestation time in the future (used in phase one only)
SCRTCH	=	Scratch pad array -- used for a variety of functions
SUMLAB	=	Labels used in summary tables at end of run
SUMMRY	=	Summary tables array
T	=	Time at center of time period K
TCONS	=	Total consumption of commodity I
TLAG	=	Gestation time for capital (years)
TPER	=	Length of time period in years
W	=	Storage array which contains every other array; W is written onto insurance file after each pass for restarts
X	=	Activity level
Z	=	Minimum consumption activity level

APPENDIX D

SOURCE CODE LISTING

```
      PROGRAM ENET
      REAL YES,NO,ONEND
      INTEGER BELL
      LOGICAL PRNTFS,RESTRT,REWND
C
C..... MAXIMUM STORAGE ALLOTMENT IS NW
C..... IF NOT ENOUGH, INCREASE NW AND CORRESPONDING DIMENSION OF W
C
      DIMENSION W(20000)
C
      COMMON /DEVICE/ ITTY,INS,IDAT,LP,NRECNO
      COMMON/ PRINTF / PRNTFS
      COMMON/ RESTRT / RESTRT,IPLOT,REWND
      COMMON/ STOP / NPASS,FOMSTP
      COMMON /YESNO/ YES,NO
C
      DATA NW/20000/
      DATA BELL/"034000000000/
C
    1 FORMAT(/,1X,'IS THIS A RESTART? (Y OR N)',$)
    2 FORMAT(A1)
    3 FORMAT(/,' FULL PRINT OF EACH PASS (Y) OR SUMMARY ONLY',
     1   ' (N)? ',$)
    4 FORMAT(1H ,/,' CPU TIME FOR THIS RUN = ',F8.3,' SECONDS')
    5 FORMAT(/,' FILE OUTPUT FOR PLOTS? (Y(ES), N(O), OR',
     1   ' E(ND)) ',$)
    7 FORMAT(/,' INPUT PASS LIMIT AND STOPPING CRITERION')
    8 FORMAT(1X,'EXCUSE ME?',A1)
    9 FORMAT(1X,/,' REWIND FILE (Y) OR APPEND TO CURRENT FILE ',
     1    '(N)? ',$)
C
C
      YES = 5HY
      NO = 5HN
      ONEND = 5HE
      IDAT = 4
      INS = 6
      ITTY = 2
      LP = 3
      OPEN(UNIT=ITTY,DEVICE='TTY')
C
   20 CONTINUE
      WRITE(ITTY,1)
      READ(ITTY,2) Y
      IF(Y.EQ.YES .OR. Y.EQ.NO)  GO TO 30
      WRITE(ITTY,8) BELL
      GO TO 20
   30 CONTINUE
      RESTRT= Y .EQ. YES
      IF(RESTRT)  GO TO 35
      OPEN(UNIT=LP,DEVICE='DSK',ACCESS='SEQOUT',
     1  MODE='ASCII',FILE='PRINT.DAT')
      OPEN(UNIT=IDAT,DEVICE='DSK',FILE='ECO.DAT',MODE='IMAGE')
      REWIND IDAT
      GO TO 40
   35 CONTINUE
      OPEN(UNIT=INS,DEVICE='DSK',FILE='INS.DAT',MODE='BINARY')
      IDAT = INS
   40 CONTINUE
      WRITE(ITTY,3)
      READ(ITTY,2) Y
      IF(Y.EQ.YES .OR. Y.EQ.NO)  GO TO 50
      WRITE(ITTY,8) BELL
      GO TO 40
```

```
   50 CONTINUE
      PRNTPS = Y .EQ. YES
   60 CONTINUE
      WRITE(ITTY,5)
      READ(ITTY,2) Y
      IF(Y.EQ.YES .OR. Y.EQ.NO .OR. Y.EQ.ONENO)  GO TO 65
      WRITE(ITTY,8) BELL
      GO TO 60
   65 CONTINUE
      IF(Y .EQ. NO)  IPLOT = -1
      IF(Y .EQ. YES)  IPLOT = +1
      IF(Y .EQ. ONENO)  IPLOT = 0
      REWND = .FALSE.
      IF(Y.EQ.NO)  GO TO 85
      REWND = .TRUE.
      IF(.NOT.RESTRT)  GO TO 85
   70 CONTINUE
      WRITE(ITTY,9)
      READ(ITTY,2) Y
      IF(Y.EQ.YES .OR. Y.EQ.NO)  GO TO 75
      WRITE(ITTY,8) BELL
      GO TO 70
   75 CONTINUE
      REWND = Y.EQ.YES
   85 CONTINUE
      WRITE(ITTY,7)
      READ(ITTY,*) NPASS,FONSTP
C
C..... INITIALIZATION
C
      CALL XMIT(-NW,0.0,W)
C
      CALL UTILIZ(T1)
      CALL STORAG(NW,W)
      CALL UTILIZ(T2)
      CPU = T2 - T1
      WRITE(ITTY,4) CPU
      WRITE(LP,4)  CPU
      CLOSE(UNIT=LP,DEVICE='DSK',FILE='PRINT.DAT')
      IF(IPLOT.GE.0)  CLOSE(UNIT=5,DEVICE='DSK',FILE='PLOT.DAT')
C
      STOP
      END
      SUBROUTINE STORAG(NW,W)
      DIMENSION W(NW)
      LOGICAL RESTRT,REWND
C
      COMMON/ RESTRT / RESTRT,IPLOT,REWND
      COMMON /DEVICE/ ITTY,ING,IDAT,LP,NRECNO
C
      DATA NGEST/10/
C
C..... ARRAY ALLOCATION DRIVER FOR ECONOMIC RECOVERY MODEL
C
    1 FORMAT(1X,/,' INPUT NUMBER OF TIME PERIODS DESIRED')
    2 FORMAT(1X,/,' STORAGE USED = ',I8,'   STORAGE AVAILABLE = ',I8)
    4 FORMAT(1X,/,' INCREASE DIMENSION OF ARRAY W IN MAIN PROGRAM TO',
     +  ' AT LEAST ',I8,/,' -- PROGRAM ABORTED',A1)
    5 FORMAT(1X,/,' WARNING -- NUMBER OF TIME PERIODS RESET TO 2 TO',
     *  ' ACCOMODATE',/,' SCRATCH PAD ARRAY USED IN EQUILIBRIUM CALC.')
C
      READ(IDAT) NACT,NCAP,NCON
      IF(RESTRT)  GO TO 40
      WRITE(ITTY,1)
      READ(ITTY,*) NPER
```

```
      IF(NPER .GE. 2)  GO TO 50
      WRITE(ITTY,5)
      NPER = 2
      GO TO 50
   40 CONTINUE
      READ(IDAT) NPER
   50 CONTINUE
      NCST = NCAP + NCON
      NPRDAC = NCST - 1
      NCONAC = NACT - NPRDAC - 1
      NCAPM1 = NCAP - 1
      NCONP1 = NCON + 1
      NPERP1 = NPER+1
      NPERP2 = NPERP1 + NGEST
      IF(IPLOT.LT.0)  GO TO 55
      NRECSZ = 5 + (NCAP*NPERP1) + (NCST*NPERP1)
     *           + (NCAPM1*NPER) + (NCAP*NPER)
     *           + (NPER*NACT) + (3*(NCST+NACT+1))
      NRECNO = 1
      OPEN(UNIT=5,DEVICE='DSK',ACCESS='RANDOM',MODE='BINARY',
     *     FILE='PLOT.DAT',RECORD SIZE=NRECSZ)
C
C..... ASSIGN STORAGE
C
   55 CONTINUE
      IFLAM = 1
      IT = IFLAM + NCST*NPERP1
      ID = IT + NPERP2
      ITLAG = ID + NCAP
      IDLMB = ITLAG + NCAPM1
      ITRAD = IDLMB + NCAP*NPER
      IFUDG = ITRAD + NCAPM1
      ICAPEF = IFUDG + NPRDAC
      ILABEF = ICAPEF + NCON
      ISCR = ILABEF + NCON
      NSCR = MAXO(NCST,18)
      IRTGT = ISCR + NSCR
      IRFUT = IRTGT + NCAPM1
      ICON = IRFUT + NCAPM1
      IARN = ICON + NCON
      IACON = IARN + NPRDAC
      IZ = IACON + NCONP1*NACT
      IGAM = IZ + NCONAC
      IB = IGAM + NACT
      ILCAP = IB + NACT
      ILCON = ILCAP + 3*NCAP
      ILACT = ILCON + 3*NCONP1
      ILPER = ILACT + 3*NACT
      IRORIG = ILPER + 3*NPER
      IRLST = IRORIG + NCAP
      IRSCL = IRLST + NCAP*NPERP2
      IGROW = IRSCL + NCAPM1
      IDISC = IGROW + NCAPM1
      IREQ = IDISC + NCAPM1
      IEFFLM = IREQ + NCAP
      IEFSO = IEFFLM + NCON
      IDTAU = IEFSO + NPER*NCAPM1
      IEFCST = IDTAU + NCAPM1
```

```
      ILO = IEFCST + NCAPM1*NPER
      IX = ILO + NCON
      IR = IX + NACT*NPER
      ISUMRY = IR + NCAP*NPERP2
      ISUMLB = ISUMRY + 6*NPER
      NEXT = ISUMLB + 18
      LAST = NEXT - 1
      WRITE(ITTY,2) LAST,NW
      IF(LAST .GT. NW)  GO TO 60
      IF(RESTRT)  READ(IDAT) (W(I),I=1,LAST)
      CALL DRIVER(NACT,NCAP,NCAPM1,NCON,NCONP1,NCST,NPRDAC,NPER,NPERP1,
     *  NPERP2,NCONAC,LAST,W(IFLAM),W(IT),W(ID),W(ITLAG),W(IDLMB),
     *  W(ITRAD),W(IFUDG),W(ICAPEF),W(ILABEF),W(ISCR),W(IRTGT),W(IRFUT),
     *  W(ICON),W(IARN),W(IACON),W(IZ),W(IGAM),W(IB),W(ILCAP),W(ILCON),
     *  W(ILACT),W(ILPER),W(IRORIG),W(IRLST),W(IRSCL),
     *  W(IGROW),W(IDISC),W(IREQ),W(IEFFLM),W(IEPSO),W(IDTAU),
     *  W(IEFCST),W(ILO),W(IX),W(IR),W(ISUMRY),W(ISUMLB),W(1))
      RETURN
C
   60 CONTINUE
      WRITE(ITTY,4) LAST,BELL
      STOP
      END
      SUBROUTINE DRIVER(NACT,NCAP,NCAPM1,NCON,NCONP1,NCST,NPRDAC,NPER,
     * NPERP1,NPERP2,NCONAC,LAST,FLAM,T,D,TLAG,DLAMB,ITRADE,FUDGE,
     *  EFFCAP,EFFLAB,SCRTCH,RTRGT,RFUT,TCONS,ARENT,ACON,Z,GAMMA,B,
     *  CAPLAB,CONLAB,ACTLAB,PERLAB,RORGNL,RLAST,RSCALE,GROWTH,DISCNT,
     *  REQ,EFFLAM,EPSO,DTAU,EFFCST,PRMLAM,X,R,SUMMRY,SUMLAB,W)
      LOGICAL RESTRT,REWND,EVERET
C
      DIMENSION X(NACT,NPER),RORGNL(NCAP),FLAM(NCST,NPERP1),T(NPERP2),
     *  R(NCAP,NPERP2),D(NCAP),TLAG(NCAPM1),DLAMB(NCAP,NPER),
     *  ARENT(NPRDAC),ACON(NCONP1,NACT),DTAU(NCAPM1),
     *  Z(NCONAC),GAMMA(NACT),B(NACT),CAPLAB(3,NCAP),CONLAB(3,NCONP1),
     *  ACTLAB(3,NACT),PERLAB(3,NPER),SCRTCH(NCST),RSCALE(NCAPM1),
     *  RLAST(NCAP,NPERP2),GROWTH(NCAPM1),
     *  EFFLAM(NCON),ITRADE(NCAPM1),FUDGE(NPRDAC),EFFCAP(NCON),
     *  DISCNT(NCAPM1),RTRGT(NCAPM1),RFUT(NCAPM1),REQ(NCAP),
     *  EPSO(NCAPM1,NPER),EFFCST(NCAPM1,NPER),
     *  EFFLAB(NCON),TCONS(NCON),PRMLAM(NCON),W(1),
     *  SUMLAB(3,6),SUMMRY(6,NPER)
C
      COMMON /EVERET/ EVERET
      COMMON /DEVICE/ ITTY,INS,IDAT,IP,NRECND
      COMMON /MERIT/ FOM,FOM2
      COMMON /PERIOD/ IPER
      COMMON/ RESTRT / RESTRT,IPLOT,REWND
      COMMON /SLOPE/ SLPMLT,MAXITR
      COMMON /TOLRNC/ ERRTOL
      COMMON /MIXER/ RESMIX
      COMMON/ LOOP / ITER,LOOP
      COMMON /PASS/ IPASS
      COMMON/ STOP / NPASS,FOMSTP
C
      DATA SLOPEO,MAXITO/5.,20/
```

```
C
    1 FORMAT(1H )
    2 FORMAT(1H1,50X,'USA ECONOMIC MODEL',/)
    3 FORMAT(1H ,//,50X,'EQUILIBRIUM FOR STUDY ECONOMY:',//,
     1  ' NOTE: POPULATION = ',F5.3,' * (TODAY''S POPULATION',
     2  ') * EXP(',F6.3,' * T)',/,' RESOURCES, ETC. ARE NOR',
     3  'MALIZED TO TODAY''S POPULATION',/)
    4 FORMAT(1X,'PASS ',I3,':',F8.3,' CPU SEC:',I5,' LOOPS: FOM = ',
     1  3G11.3)
    5 FORMAT(1H ,/,' EQUILIBRIUM ECONOMY:',//,'  *** RELATIVE ',
     1  'STANDARD OF LIVING = ',G13.5)
    6 FORMAT(1H1,42X,'FINAL MODEL RESULTS:',/,' CONVERGENCE ON PASS',
     1  I4,/)
    7 FORMAT(1H1,50X,'STARTING RESOURCES:'//' NOTE:  RESOURCES ARE',
     *  ' NORMALIZED TO TODAY''S POPULATION')
    8 FORMAT(1X,/,' *** MUST REPEAT PASS 1 ***',/)
    9 FORMAT(1X,/,' *** BEGINNING PHASE 2 ***',/)
   10 FORMAT(1H ,' *** TOTAL CONSUMPTION (EXCLUDING LEISURE) = ',
     1  G13.5,/,'  *** TOTAL INVESTMENT = ',G13.5,/,'  *** GNP = ',
     2  G13.5,/,'  *** TOTAL PRODUCTION = ',G13.5,/,
     3  '  *** TOTAL CAPITAL INVENTORY = ',G13.5,/)
   11 FORMAT(1H ,/,' CURRENT ECONOMY:',/)
C
      SUMLAB(1,1) = 5HSTAND
      SUMLAB(2,1) = 5HARD O
      SUMLAB(3,1) = 5HF LIV
      SUMLAB(1,2) = 5H  CON
      SUMLAB(2,2) = 5HSUMPT
      SUMLAB(3,2) = 5HION
      SUMLAB(1,3) = 5H  INV
      SUMLAB(2,3) = 5HESTME
      SUMLAB(3,3) = 5HNT
      SUMLAB(1,4) = 5H
      SUMLAB(2,4) = 5H GNP
      SUMLAB(3,4) = 5H
      SUMLAB(1,5) = 5HTOTAL
      SUMLAB(2,5) = 5H PROD
      SUMLAB(3,5) = 5HUCTN
      SUMLAB(1,6) = 5HCAPIT
      SUMLAB(2,6) = 5HAL IN
      SUMLAB(3,6) = 5HVEN'Y
C
      IF(RESTRT)  GO TO 150
C
C     GET INPUT DATA
C
      CALL INPUT(NACT,NCAP,NCAPM1,NCON,NCONP1,NCST,NPRDAC,NPER,
     * NPERP1,NPERP2,NCONAC,T,D,TLAG,ITRADE,
     *  SCRTCH,ARENT,ACON,Z,GAMMA,B,CAPLAB,CONLAB,ACTLAB,PERLAB,
     *  GROWTH,DISCNT,DTAU,X,R)
      WRITE(LP,11)
      CALL SUMARY(NCST,NCAPM1,NACT,X,R,SUMMRY)
      WRITE(LP,10) (SUMMRY(I,1),I=1,5)
C
C..... STORE RESOURCE LEVELS USED FOR STUDY
```

```
C
      FO = SCRTCH(NCAP)
      DO 110  J = 1,NCAPM1
        RORGNL(J) = R(J,1) * SCRTCH(J)/FO
  110 CONTINUE
      RORGNL(NCAP) = R(NCAP,1)
C
C..... CALCULATE CURRENT ECONOMY'S UTILITY AND PRODUCTION PARAMETERS
C
      CALL CURRNT(NCON,NCAP,NCAPM1,NPRDAC,NCONAC,NACT,
     1  X,Z,R,SCRTCH,SOLNOM,GAMMA(NCST),B(NCST),
     2  GAMMA,B,GAMSUM,DLAMB,ITRADE,FUDGE,ARENT,CAPLAB,ACTLAB)
C
C..... CALCULATE EQUILIBRIUM STATE
C
      WRITE(LP,3) FO,B(NCAP)
      CALL XMIT(-NCST,1.0,FLAM)
      CALL XMIT(NCAP,R,REQ)
      CALL EQLBRM(NCON,NCONP1,NCAP,NCST,NCAPM1,NPRDAC,NCONAC,NACT,REQ,
     1  X,Z,DLAMB,FLAM,EFFLAM,FUDGE,EFFCAP,EFFLAB,GAMMA(NCST),B(NCST),
     2  GAMMA,B,ITRADE,D,ACON,DISCNT,DTAU,TLAG,TPER,SCRTCH,
     3  CAPLAB,CONLAB,ACTLAB,ARENT(NCAP),TCONS,PRMLAM)
      SOL = SOLF(NCONAC,X(NCST,1),Z,GAMMA(NCST),B(NCST))
      SOL = SOL / SOLNOM
      WRITE(LP,5) SOL
      CALL SUMARY(NCST,NCAPM1,NACT,X,REQ,SUMMRY)
      WRITE(LP,10) (SUMMRY(I,1),I=1,5)
C
C..... STARTING SITUATION
C
      WRITE(LP,7)
      CALL PRARI(RORGNL,NCAP,15H   STARTING RES,CAPLAB,LP,132)
C
C..... INITIALIZATION
C
      CALL EFFKAP(EFFCAP,FUDGE,GAMMA,B,ITRADE,RORGNL,NCON,NCAPM1)
      CALL EFFKAP(SCRTCH,FUDGE,GAMMA,B,ITRADE,REQ,NCON,NCAPM1)
      DO 120  I = 1,NCON
         II = I + NCAPM1
         X(II,1) = X(II,1) * EFFCAP(I)/SCRTCH(I)
  120 CONTINUE
      DO 130  K = 2,NPERP2
         CALL XMIT(NCAP,REQ,RLAST(1,K))
         IF(K.GT.NPERP1)  GO TO 130
         CALL XMIT(NCST,FLAM(1,1),FLAM(1,K))
  130 CONTINUE
      CALL XMIT(NCAP,DLAMB(1,1),FLAM(1,1))
      CALL XMIT(NCAP,REQ,RLAST(1,1))
      CALL XMIT(NCAPM1,X,RSCALE)
C
C     NOTE: FLAM(J,1) IS USED ABOVE TO STORE THE HORIZON RENTAL
C     VALUE FOR CAPITAL ITEMS.  SINCE THE MODEL USES FLAM(J,K+1)
C     IN ITS CALCULATION FOR TIME PERIOD K, FLAM(J,1) IS AVAILABLE
C     FOR THIS.
C
```

```
      IPASS = 1
      EVEREI = .FALSE.
      ERRTOL = 0.005
      WRITE(LP,2)
      CLOSE(UNIT=LP,DEVICE='DSK',FILE='PRINT.DAT')
  150 CONTINUE
      TCONS = .50
      DELTA = .5
      FOM3 = 1.0
      SLFMLT = SLOPEO
      MAXITR = MAXITO
      RESMIX = 5.0
      NPASS = MINO(20,NPASS/2)
      IF(RESTRT)  READ(IDAT) IPER,SOLNOM,GAMSUM,ERRTOL,EVEREI,IPASS
      IF(RESTRT)  CLOSE(UNIT=INS,DEVICE='DSK',FILE='INS.DAT')
      IF(IPLOT.GE.0 .AND. .NOT.REWND)  NRECNO = IPASS
C
C..... MAIN DRIVER -- PASS LOOP
C
  200 CONTINUE
      CALL STOPIT
      OPEN(UNIT=LP,DEVICE='DSK',ACCESS='APPEND',
     1  MODE='ASCII',FILE='PRINT.DAT')
      CALL UTILIZ(CPU1)
      CALL TIMPER(NCON,NCAP,NCAPM1,NCST,NPRDAC,NCONAC,NACT,NPER,NCONP1,
     1  NPERP1,NPERP2,R,RLAST,GROWTH,D,T,TLAG,DTAU,DLAMB,FLAM,RTROT,
     2  RFUT,X,Z,GAMMA,B,ITRADE,FUDGE,EFFCAP,EFFLAB,ACON,RORGNL,
     3  SCRTCH,EFFCST,EFFLAM,TCONS,REQ,PRMLAM,RSCALE)
      CALL UTILIZ(CPU2)
      CPU = CPU2 - CPU1
      FOM = 1.0
      IF(IPASS .EQ. 1)  GO TO 230
      SUM = 0.0
      SUM1 = 0.0
      DO 220  K = 1,NPER
         DO 210  J = 1,NCAPM1
            SUM = SUM+((RLAST(J,K)-R(J,K))**2)/(0.5*(RLAST(J,K)+R(J,K)))
            SUM1 = SUM1 + 0.5*(RLAST(J,K)+R(J,K))
  210    CONTINUE
  220 CONTINUE
      FOM = SQRT(SUM/SUM1)
      GO TO 270
  230 CONTINUE
      DO 250  J = 1,NCAPM1
         IF(R(J,NPER) .LT. 0.95*REQ(J))  GO TO 260
  250 CONTINUE
      SLFMLT = SLOPEO
      DO 240  K = 1,NPER
         CALL XMIT(NCAPM1,X(1,K),EPSO(1,K))
  240 CONTINUE
      GO TO 270
  260 CONTINUE
      SLFMLT = SLFMLT / 2.0
      WRITE(ITTY,8)
      WRITE(LP,8)
      GO TO 200
  270 CONTINUE
      IF(.NOT.EVEREI)  GO TO 310
      SUM = 0.0
      SUM1 = 0.0
      DO 305  K = 1,NPER
```

```
      DO 300  J = 1,NCAPM1
         SUM = SUM + EFFCST(J,K)*X(J,K)*EPSO(J,K)**2
         SUM1 = SUM1 + EFFCST(J,K)*X(J,K)
300   CONTINUE
305 CONTINUE
    ERRTOL = AMIN1(ERRTOL,FOM2/20.)
    ERRTOL = AMAX1(ERRTOL,0.0001)
    FOM3 = SQRT(SUM/SUM1)
310 CONTINUE
    WRITE(ITTY,4) IPASS,CPU,LOOF,FOM,FOM2,FOM3
    WRITE(LP,4) IPASS,CPU,LOOF,FOM,FOM2,FOM3
C
    IFLAG = +1
    IF(IPASS.GE.NPASS .OR. FOM2.LE.FOMSTP)  IFLAG = -1
C
C   CALCULATE FLAMS FOR CAPITAL ITEMS BY PROPAGATING DELTA LAMBDAS
C   BACK THROUGH TIME
C
    CALL LAMBAC(NPER,NCAP,NCAPM1,NCST,NPERP1,NPERP2,T,D,FLAM,DLAMB,
   * TLAG,DTAU,DISCNT,EFFCST,R,REQ,IFLAG)
    IF(IFLAG .LE. 0)  GO TO 350
    IF(EVERET)  GO TO 330
    DO 320  K = 1,NPER
       DO 315  J = 1,NCAPM1
          EPSO(J,K) = 0.3*EPSO(J,K) + 0.7*X(J,K)
315    CONTINUE
320 CONTINUE
    IF(FOM.GT.0.005 .AND. IPASS.LT.NPASS)  GO TO 345
    EVERET = .TRUE.
    WRITE(ITTY,9)
    WRITE(LP,9)
    DO 325  K = 1,NPER
       K1 = K + 1
       DO 324  J = 1,NCAPM1
          X(J,K) = AMAX1(EPSO(J,K),0.001*X(J,NPER))
          DIF = FLAM(J,K1) - EFFCST(J,K)
          EPSO(J,K) = SIGN(0.05,DIF)
324    CONTINUE
325 CONTINUE
330 CONTINUE
    DO 340  K = 1,NPER
       K1 = K + 1
       DO 335  J = 1,NCAPM1
          DIF = FLAM(J,K1) - EFFCST(J,K)
          IF(X(J,K) .GT. 0.0)  GO TO 332
          IF(DIF .LE. 0.0)  GO TO 335
          X(J,K) = 0.0005*X(J,NPER)
          EPSO(J,K) = 0.05
332       CONTINUE
          F0 = -DELTA
          IF(DIF*EPSO(J,K) .GT. 0.0)  F0 = FCONS*DELTA
          EPSO(J,K) = ABS(EPSO(J,K)) * (1.0+F0)
          EPSO(J,K) = AMIN1(EPSO(J,K),0.9)
          EPSO(J,K) = SIGN(EPSO(J,K),DIF)
          X(J,K) = X(J,K)*(1.0+EPSO(J,K))
          IF(EPSO(J,K).GT.-0.8 .OR. X(J,K).GT.1.0E-04*X(J,NPER))
     1       GO TO 335
          X(J,K) = 0.0
          EPSO(J,K) = 0.0
```

```
  335     CONTINUE
  340 CONTINUE
  345 CONTINUE
      CALL XMIT(NCAP*NPER+2,R,RLAST)
      IPASS = IPASS + 1
C
C     CREATE INSURANCE FILE ...
C
      OPEN(UNIT=INS,DEVICE='DSK',FILE='INS.DAT',MODE='BINARY')
      WRITE(INS) NACT,NCAP,NCON
      WRITE(INS) NPER
      WRITE(INS) (W(I),I=1,LAST)
      WRITE(INS) IPER,SOLNOM,GAMSUM,ERRTOL,EVERET,IPASS
      CLOSE(UNIT=INS,DEVICE='DSK',FILE='INS.DAT')
      CLOSE(UNIT=LP,DEVICE='DSK',FILE='PRINT.DAT')
      WRITE(ITTY,1)
C
C     CREATE TAPE FOR PLOTTING ROUTINES
C
      IF(IPLOT .LE. 0)  GO TO 200
      CALL PLTOUT(NCAP,NCON,NACT,NPER,SCRTCH,R,
     1  FLAM,EFFCST,DLAMB,X,CAPLAB)
      GO TO 200
C
C     CONVERGENCE
C
  350 CONTINUE
      IF(IPLOT .GE. 0)  CALL PLTOUT(NCAP,NCON,NACT,NPER,
     1  SCRTCH,R,FLAM,EFFCST,DLAMB,X,CAPLAB)
      WRITE(LP,6) IPASS
      CALL PRAR2(R,NCAP,NPER,15H       INVENTORY,CAPLAB,PERLAB,LP,132)
      CALL PRAR2(X,NACT,NPER,15H      ACTIVITIES,ACTLAB,PERLAB,LP,132)
      CALL PRAR1(FLAM,NCAPM1,15H SHADOW VAL T=0,CAPLAB,LP,132)
      CALL PRAR2(FLAM(1,2),NCST,NPER,15H   SHADOW VALUE,CAPLAB,
     1   PERLAB,LP,132)
      CALL PRAR2(DLAMB,NCAP,NPER,15H   RENTAL VALUE,CAPLAB,
     1   PERLAB,LP,132)
      CALL PRAR2(EFFCST,NCAPM1,NPER,15HCOST OF PRODCTN,CAPLAB,
     1   PERLAB,LP,132)
      DO 370  K = 1,NPER
         DO 360  I = 1,NCAPM1
            EFFCST(I,K) = (EFFCST(I,K)-FLAM(I,K+1))/FLAM(I,K+1)
  360    CONTINUE
  370 CONTINUE
      CALL PRAR2(EFFCST,NCAPM1,NPER,15HFRACTNL DIFFRNC,CAPLAB,
     1   PERLAB,LP,132)
      CALL PRAR2(EPSO,NCAPM1,NPER,15HEVERETT EPSILON,CAPLAB,
     1   PERLAB,LP,132)
      DO 450  K = 1,NPER
         CALL XMIT(-6,0.0,SUMMRY(1,K))
         SOL = SOLF(NCONAC,X(NCST,K),Z,GAMMA(NCST),B(NCST))
         SUMMRY(1,K) = SOL / SOLNOM
         CALL SUMARY(NCST,NCAPM1,NACT,X(1,K),R(1,K),SUMMRY(2,K))
  450 CONTINUE
      CALL PRAR2(SUMMRY,6,NPER,15H        SUMMARY,SUMLAB,PERLAB,LP,132)
      RETURN
      END
```

```
      SUBROUTINE  INFO(NACT,NCAP,NCAPM1,NCON,NCONP1,NCST,NPRDAC,NPER,
     * NPERP1,NPERP2,NCONAC,T,B,TLAG,TTRADE,
     *   SCRTCH,ARENT,ACON,Z,GAMMA,B,CAPLAB,CONLAB,ACTLAB,PERLAB,
     *   GROWTH,DISCNT,DTAU,X,K)
      DIMENSION COM(4),ICOM(4),NTYPE(4),XCOM(8)
      REAL  YES,NO
      INTEGER BELL
C
      DIMENSION X(NACT),T(NPERP2),K(NCAP),B(NCAP),TLAG(NCAPM1),
     *   ARENT(NPRDAC),ACON(NCONP1,NACT),DTAU(NCAPM1),
     *   Z(NCONAC),GAMMA(NACT),B(NACT),CAPLAB(3,NCAP),CONLAB(3,NCONP1),
     *   ACTLAB(3,NACT),PERLAB(3,NPER),SCRTCH(NCST),GROWTH(NCAPM1),
     *   TTRADE(NCAPM1),DISCNT(NCAPM1)
C
      COMMON /DEVICE/ ITTY,INS,IDAT,LP,NRECNO
      COMMON /PERIOD/ TPER
      COMMON /YESNO/ YES,NO
C
      EQUIVALENCE (COM,ICOM)
C
      DATA BELL/"034000000000/
      DATA NTYPE/-1,1,2,2/
      DATA XCOM/4HM    ,4HB    ,4HBETA,4HBET2,4HG    ,4HF    ,4HZ    ,4HE    /
C
    1 FORMAT(1H1,50X,'DSA ECONOMIC MODEL',/)
    2 FORMAT(1X,/,' INPUT LENGTH OF TIME PERIOD (YEARS)')
    3 FORMAT(1X,/,' TIME PERIOD LENGTH MAY NOT BE GREATER THAN ',F6.2,
     1   ',',/,' I.E., 2. * MINIMUM GESTATION TIME OF ',F6.2,A1)
    4 FORMAT(1H ,/,' CAPITAL',6X,'CONSUMABLES',6X,'PROD ACT',5X,'CONSP',
     *   'T ACT',5X,'TOTAL ACT'/4X,I3,12X,I3,13X,I3,11X,I3,11X,I3)
    5 FORMAT(1H ,/,' THIS RUN CONTINUES FOR ',I3,' TIME PERIODS OF ',
     *   'LENGTH',F6.2,' YEARS')
    6 FORMAT(1X,/,' BASIC PARAMETER ARRAYS ARE ON LINE PRINTER')
    7 FORMAT(1H ,//,50X,'BASIC PARAMETER ARRAYS!')
    8 FORMAT(A1)
    9 FORMAT(1X,/,' MENU:     Z = MINIMUM CONSUMPTION ACTIVITY',/,10X,
     1 'B = UTILITY EXPONENT FOR CONSUMPTION ACTIVITITY',/,10X,
     2  'G = RATIO OF POST-ATTACK UTILITY COEFFICIENTS TO TODAY''S ',
     3  /,14X,'UTILITY COEFICIENTS',/,7X,'BETA = TRANSLOG EXPONENT ',
     4  'FOR CAPITAL/LABOR TRADEOFFS',/,14X,'(IF .LT. -1.0, BETA IS ',
     *  'CALCULATED TO GIVE THE',/,14X,'LIMITING PRODUCTIVITY A VALUE ',
     *  'OF ABS(INPUT VALUE))',/,7X,'BET2 = TRANSLOG ',
     5  'EXPONENT FOR CAPITAL/CAPITAL TRADEOFFS',/,14X,' (ONLY FOR ',
     6  'THOSE PRODUCTION ACTIVITIES USING 2 TYPES',/,14X,'OF CAPI',
     7  'TAL)',/,10X,'F = FRACTION OF CAPITAL SURVIVING',/,10X,'M = ',
     8  'REDISPLAY MENU',/,10X,'E = END OF REQUESTS',/)
   10 FORMAT(1X,//,50X,'BASIC DATA ARRAYS!')
   11 FORMAT(1X,/,' EXCUSE ME?',A1)
   12 FORMAT(1X,'RANGE MUST BE BETWEEN 1 AND ',I3)
   13 FORMAT(1X,/,' INPUT NEXT CHANGE --')
   14 FORMAT(1X,'TYPE "M" TO DISPLAY MENU')
   15 FORMAT(1X,/,' WOULD YOU LIKE BASIC PARAMETER ARRAYS PRINTED ON ',
     1   'LP? (Y OR N)')
   16 FORMAT(1X,/,' WOULD YOU LIKE ANY OF THE BASIC PARAMETER ARRAYS ',
     1   'DISPLAYED? (Y OR N)')
   17 FORMAT(1X,/,  ' WOULD YOU LIKE TO CHANGE ANY OF THE DATA?  ',
     1   '(Y OR N)')
   18 FORMAT(1X,/,' INPUT ARRAY NAME, DATA CHANGE, AND INDUSTRY ',
     1   'NUMBER',/,' (OR RANGE OF INDUSTRY NUMBERS)')
   19 FORMAT(1X,/,' INPUT ARRAY NAME')
   20 FORMAT(3HPER,I4,8X)
```

```
C
C     NOTE WELL:
C     ACTIVITIES MUST BE LISTED IN THE FOLLOWING ORDER --
C     THE FIRST NCAP-1 ACTIVITIES ARE THE PRODUCTION OF THE NCAP-1
C     CAPITAL RESOURCES (NOTE THAT THE NCAP'TH RESOURCE IS MANPOWER,
C     AND MUST BE INPUT ACCORDINGLY).
C     THE NEXT NCON ACTIVITIES ARE THE PRODUCTION OF THE NCON CONSUM
C     ABLES, MAKING A TOTAL OF NCST - 1 (NPRDAC) PRODUCTION ACTIVITIES.
C     THE NEXT ACTIVITIES ARE THE CONSUMPTION ACTIVITIES.  THE FIRST
C     CONSUMPTION ACTIVITY (THE NCST'TH ACTIVITY) MUST BE CONSUMPTION
C     OF LEISURE.  THE REMAINING NACT - NCST-1 ACTIVITIES ARE THE CON-
C     SUMPTION ACTIVITIES (ANY ORDER) OF THE NCON CONSUMABLES.
C     THERE MAY BE ANY NUMBER OF THESE CONSUMPTION ACTIVITIES, AND THEY
C     MAY CONSUME MORE THAN ONE OF THE NCON CONSUMABLES.
C     THE LAST ACTIVITY IS EXPORTS (IMPORTS).
C
C..... READ LABELS
C
      READ(IDAT) CAPLAB,CONLAB
      READ(IDAT) ACTLAB
      DO 50  K = 1,NPER
        ENCODE(15,20,PERLAB(1,K)) K
   50 CONTINUE
C
C..... READ BASIC ARRAYS
C
C     NOTE: SCRTCH INITIALLY HOLDS THE FRACTION OF TODAY'S RESOURCES
C     AVAILABLE AT START OF RUN.  LATER IT IS A SCRATCH PAD ARRAY.
C     NOTE ALSO THAT THE FIRST NPRDAC (# PRODUCTION ACTIVITIES) ENTRIES
C     IN THE GAMMA, B, AND FUDGE MATRICES ARE THE PRODUCTION PARAMETERS
C     (FIRST NCAPM1 FOR INTERNAL CAPITAL TRADEOFFS, AND THE NEXT NCON
C     FOR THE CAPITAL LABOR TRADEOFFS FOR THE PRODUCTION OF THE NCON
C     CONSUMABLES), WHILE THE REMAINING NACT-NPRDAC (NCONAC) ENTRIES
C     ARE THE UTILITY PARAMETERS (B AND GAMMA ONLY) FOR THE CONSUMPTION
C     ACTIVITIES.  FUDGE ARRAY IS THE NORMALIZING FACTORS FOR THE PRO-
C     DUCTION ACTIVITIES.  NO INPUTS TO GAMMA ARRAY, EXCEPT THAT
C     THE UTILITY GAMMAS SHOULD BE INPUT AS THE RATIO POSTATTACK/CURRENT
C     (NORMALLY UNITY).
C     THE ARENT MATRIX CONSISTS OF DOLLARS PER ACTIVITY SPENT ON CAPITAL
C     (FIRST NCAPM1) AND DOLLARS FOR (OR UNITS OF) LABOR SPENT ON THE
C     PRODUCTION OF THE CONSUMABLES (NEXT NCON ELEMENTS).
C
      NACTM1 = NACT - 1
      READ(IDAT) X
      READ(IDAT) R
      READ(IDAT) TLAG
      TLAGMN = 1.0E+20
      TLAGMX = 0.0
      DO 55  J = 1,NCAPM1
        TLAGMN = AMIN1(TLAG(J), TLAGMN)
        TLAGMX = AMAX1(TLAG(J),TLAGMX)
   55 CONTINUE
      READ(IDAT) D
      READ(IDAT) DISCNT
      READ(IDAT) GROWTH
      READ(IDAT) ARENT
      READ(IDAT) (SCRTCH(J),J=1,NCAP)
      READ(IDAT) B
      READ(IDAT) (GAMMA(I),I=NCST,NACTM1)
```

```
      READ(IDAT) Z
      READ(IDAT) ACON
      READ(IDAT) ITRAN
   60 CONTINUE
      WRITE(ITTY,2)
      READ(ITTY,*) TPER
      TLAGM2 = 2.*TLAGMN
      IF(TPER .LE. TLAGM2)  GO TO 65
      WRITE(ITTY,3) TLAGM2,TLAGMN,BELL
      GO TO 60
   65 CONTINUE
      DO 70  K = 1,NPERP2
        XK = K - 1
        T(K) = TPER * (XK + 0.5)
   70 CONTINUE
      NPERMX = (T(NPERP1) + 1.5*TPER + TLAGMX)/TPER + 0.001
      IF(NPERMX.GT.NPERP2)  CALL ZABORT(
     1   ';INCREASE SIZE OF NGEST IN 'STORAGE' FOR MAX GEST. TIME;')
      DO 75  J = 1,NCAPM1
        XLAG = TLAG(J) / TPER
        JLAG = XLAG + 1.0E-10
        YLAG = JLAG
        DTAU(J) = (1.0-XLAG+YLAG)*TPER
   75 CONTINUE
C
C..... PRINT BASIC ARRAYS
C
   80 CONTINUE
      WRITE(ITTY,15)
      READ(ITTY,8) Y
      IF(Y.EQ.NO)  GO TO 82
      IF(Y.EQ.YES)  GO TO 81
      WRITE(ITTY,11) BELL
      GO TO 80
   81 CONTINUE
      WRITE(LP,1)
      WRITE(LP,4) NCAP,NCON,NPRDAC,NCONAC,NACT
      WRITE(LP,7)
      CALL PRARI(Z,NCONAC,15HMINIMUM ACTIVTY,ACTLAB(1,NCST),LP,132)
      CALL PRARI(B(NCST),NCONAC,15HB(UTILITY-ELAS),ACTLAB(1,NCST),
     1   LP,132)
      CALL PRARI(GAMMA(NCST),NCONAC,15H  WEIGHT FACTOR,
     1   ACTLAB(1,NCST),LP,132)
      CALL PRARI(B(NCAP),NCON,15HBETA F-CONSUMBL,ACTLAB(1,NCAP),LP,132)
      CALL PRARI(B,NCAPM1,15HBETA CAPL-TRADE,CAPLAB,LP,132)
      CALL PRARI(SCRTCH,NCAP,15H FRACTIONAL RES,CAPLAB,LP,132)
      CLOSE (UNIT=LP,DEVICE='DSK',FILE='PRINT.DAT',DISPOSE='PRINT')
      OPEN(UNIT=LP,DEVICE='DSK',FILE='PRINT.DAT',ACCESS='SEQOUT',
     1  MODE='ASCII')
      WRITE(ITTY,6)
      GO TO 93
   82 CONTINUE
      WRITE(ITTY,16)
      READ(ITTY,8) Y
      IF(Y.EQ.NO)  GO TO 93
      IF(Y.EQ.YES)  GO TO 84
      WRITE(ITTY,11) BELL
      GO TO 82
   83 CONTINUE
      WRITE(ITTY,9)
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```
   83 CONTINUE
      WRITE(ITTY,19)
      WRITE(ITTY,13)
      CALL COMAND(1,NTYPE,COM,ITTY)
      DO 85  I = 1,8
         IF(COM(1) .EQ. XCOM(I))  GO TO 86
   85 CONTINUE
      WRITE(ITTY,11) BELL
      GO TO 84
   86 CONTINUE
      IF(I .EQ. 1)  GO TO 83
      IF(I .EQ. 2)  CALL PRAR1(B(NCST),NCONAC,15HUTILITY ELASTCY,
     1   ACTLAB(1,NCST),ITTY,80)
      IF(I .EQ. 3)  CALL PRAR1(B(NCAP),NCON,15HBETA CAPL/LABOR,
     1   ACTLAB(1,NCAP),ITTY,80)
      IF(I .EQ. 4)  CALL PRAR1(B,NCAPM1,15H BETA CAPL/CAPL,CAPLAB,
     1   ITTY,80)
      IF(I .EQ. 5)  CALL PRAR1(GAMMA(NCST),NCONAC,15H  WEIGHT FACTOR,
     1   ACTLAB(1,NCST),ITTY,80)
      IF(I .EQ. 6)  CALL PRAR1(SCRTCH,NCAP,15H FRACTIONAL RES,
     1   CAPLAB,ITTY,80)
      IF(I .EQ. 7)  CALL PRAR1(Z,NCONAC,15HMINIMUM ACTIVTY,
     1   ACTLAB(1,NCST),ITTY,80)
      IF(I .NE. 8)  GO TO 84
   93 CONTINUE
      WRITE(ITTY,17)
      READ(ITTY,8) Y
      IF(Y .EQ. NO)  GO TO 130
      IF(Y.EQ.YES)  GO TO 95
      WRITE(ITTY,11) BELL
      GO TO 93
   94 CONTINUE
      WRITE(ITTY,9)
      WRITE(ITTY,18)
      GO TO 96
   95 CONTINUE
      WRITE(ITTY,18)
      WRITE(ITTY,14)
   96 CONTINUE
      CALL COMAND(4,NTYPE,COM,ITTY)
      IF(ICOM(4) .EQ. 0)  ICOM(4) = ICOM(3)
      J1 = ICOM(3)
      J2 = ICOM(4)
      DO 98  I = 1,8
         IF(COM(1) .EQ. XCOM(I)) GO TO 99
   98 CONTINUE
      WRITE(ITTY,11) BELL
      GO TO 95
   99 CONTINUE
      GOTO(94,100,105,110,115,120,125,80), I
  100 CONTINUE
      IF(J1.GT.0 .AND. J2.GE.J1 .AND. J2.LE.NCONAC)  GO TO 101
      WRITE(ITTY,11) BELL
      IF(J1.LE.0 .OR. J2.GT.NCONAC)  WRITE(ITTY,12) NCONAC
      GO TO 96
  101 CONTINUE
```

```
      DO 102  J = J1,J2
         K = NCST+J-1
         B(K) = COM(2)
  102 CONTINUE
      WRITE(ITTY,13)
      WRITE(ITTY,14)
      GO TO 96
  105 CONTINUE
      IF(J1.GT.0 .AND. J2.GE.J1 .AND. J2.LE.NCON)  GO TO 106
      WRITE(ITTY,11) BELL
      IF(J1.LE.0 .OR. J2.GT.NCON)  WRITE(ITTY,12) NCON
      GO TO 95
  106 CONTINUE
      DO 107  J = J1,J2
         K = NCAP+J-1
         B(K) = COM(2)
  107 CONTINUE
      WRITE(ITTY,13)
      WRITE(ITTY,14)
      GO TO 96
  110 CONTINUE
      IF(J1.GT.0 .AND. J2.GE.J1 .AND. J2.LE.NCAPM1)  GO TO 111
      WRITE(ITTY,11) BELL
      IF(J1.LE.0 .OR. J2.GT.NCAPM1)  WRITE(ITTY,12) NCAPM1
      GO TO 95
  111 CONTINUE
      DO 112  J = J1,J2
         B(J) = COM(2)
  112 CONTINUE
      WRITE(ITTY,13)
      WRITE(ITTY,14)
      GO TO 96
  115 CONTINUE
      IF(J1.GT.0 .AND. J2.GE.J1 .AND. J2.LE.NCONAC)  GO TO 116
      WRITE(ITTY,11) BELL
      IF(J1.LE.0 .OR. J2.GT.NCONAC)  WRITE(ITTY,12) NCONAC
      GO TO 95
  116 CONTINUE
      DO 117  J = J1,J2
         K = NCST+J-1
         GAMMA(K) = COM(2)
  117 CONTINUE
      WRITE(ITTY,13)
      WRITE(ITTY,14)
      GO TO 96
  120 CONTINUE
      IF(J1.GT.0 .AND. J2.GE.J1 .AND. J2.LE.NCAP)  GO TO 121
      WRITE(ITTY,11) BELL
      IF(J1.LE.0 .OR. J2.GT.NCAP)  WRITE(ITTY,12) NCAP
      GO TO 95
  121 CONTINUE
      DO 122  J = J1,J2
         SCRTCH(J) = COM(2)
  122 CONTINUE
      WRITE(ITTY,13)
      WRITE(ITTY,14)
      GO TO 96
```

```
125 CONTINUE
    IF(J1.GT.0 .AND. J2.GE.J1 .AND. J2.LE.NCONAC)  GO TO 126
    WRITE(ITTY,11) BELL
    IF(J1.LE.0 .OR. J2.GT.NCONAC)  WRITE(ITTY,12) NCONAC
    GO TO 95
126 CONTINUE
    DO 127  J = J1,J2
       Z(J) = COM(2)
127 CONTINUE
    WRITE(ITTY,13)
    WRITE(ITTY,14)
    GO TO 96
130 CONTINUE
    WRITE(LP,1)
    WRITE(LP,5) NPER,IPER
    WRITE(LP,4) NCAP,NCON,NPRDAC,NCONAC,NACT
    WRITE(LP,7)
    CALL PRAR1(Z,NCONAC,15HMINIMUM ACTIVTY,ACTLAB(1,NCST),LP,132)
    CALL PRAR1(B(NCST),NCONAC,15HB(UTILITY-ELAS),ACTLAB(1,NCST),
   1     LP,132)
    CALL PRAR1(GAMMA(NCST),NCONAC,15H  WEIGHT FACTOR,
   1  ACTLAB(1,NCST),LP,132)
    CALL PRAR1(B(NCAP),NCON,15HBETA P-CONSUMBL,ACTLAB(1,NCAP),LP,132)
    CALL PRAR1(B,NCAPM1,15HBETA CAPL-TRADE,CAPLAB,LP,132)
    CALL PRAR1(SCRTCH,NCAP,15H FRACTIONAL RES,CAPLAB,LP,132)
    WRITE(LP,10)
    CALL PRAR1(X,NACT,15HTODAY'S ACTIVTY,ACTLAB,LP,132)
    CALL PRAR1(R,NCAP,15H      RESOURCES,CAPLAB,LP,132)
    CALL PRAR1(TLAG,NCAPM1,15H GESTATION TIME,CAPLAB,LP,132)
    D(NCAP) = -D(NCAP)
    CALL PRAR1(D,NCAP,15H   DEPRECIATION,CAPLAB,LP,132)
    D(NCAP) = -D(NCAP)
    CALL PRAR1(GROWTH,NCAPM1,15H  GROWTH FACTOR,CAPLAB,LP,132)
    CALL PRAR1(DISCNT,NCAPM1,15H      DISCOUNTS,CAPLAB,LP,132)
    CALL PRAR2(ACON,NCONP1,NACT,15HCONSUMPT MATRIX,CONLAB,
   1     ACTLAB,LP,132)
    CALL PRAR1(ARENT,NCAPM1,15H  RENTAL MATRIX,CAPLAB,LP,132)
    CALL PRAR1(ARENT(NCAP),NCON,15H   LABOR RENTAL,
   1    ACTLAB(1,NCAP),LP,132)
    REWIND IDAT
    WRITE(IDAT) NACT,NCAP,NCON
    WRITE(IDAT) CAPLAB,CONLAB
    WRITE(IDAT) ACTLAB
    WRITE(IDAT) X
    WRITE(IDAT) R
    WRITE(IDAT) TLAG
    WRITE(IDAT) D
    WRITE(IDAT) DISCNT
    WRITE(IDAT) GROWTH
    WRITE(IDAT) ARENT
    WRITE(IDAT) (SCRTCH(J),J=1,NCAP)
    WRITE(IDAT) B
    WRITE(IDAT) (GAMMA(I),I=NCST,NACTM1)
    WRITE(IDAT) Z
    WRITE(IDAT) ACON
    WRITE(IDAT) ITRADE
    CLOSE(UNIT=IDAT,DEVICE='DSK',FILE='ECO.DAT')
    RETURN
```

```
      END
      SUBROUTINE CURRNT(NCON,NCAP,NCAPM1,NPRDAC,NCONAC,NACT,
     1  X,Z,R,SCRTCH,SOLNOM,GAMMA,B,GAMMAP,BETA,
     2  GAMSUM,DLAMB,ITRADE,FUDGE,ARENT,CAPLAB,ACTLAB)
C
C     THIS SUBROUTINE CALCULATES THE CURRENT ECONOMY'S UTILITY AND
C     PRODUCTION PARAMETERS.
C
      DIMENSION X(NACT),R(NCAP),SCRTCH(NCONAC),GAMMA(NCONAC),B(NCONAC),
     1  GAMMAP(NPRDAC),BETA(NPRDAC),DLAMB(NCAP),
     2  ITRADE(NCAPM1),FUDGE(NPRDAC),ARENT(NPRDAC),CAPLAB(3,NCAP),
     4  ACTLAB(3,NACT),Z(NCONAC),INDEX(2)
C
      COMMON /DEVICE/ ITTY,INS,IDAT,LP,NRECNO
C
    2 FORMAT(1H0,/,50X,'CURRENT ECONOMY  -- DERIVED PARAMETERS!',/)
    3 FORMAT(1H ,'POSITIVE GAMMA IMPLIES GAMMA FOR CAPITAL; NEGATIVE',
     1  ' GAMMA IMPLIES GAMMA FOR LABOR',/,' (GAMMA(K) + GAMMA(L) = ',
     2  '1.0)')
C
C     FIND UTILITY PARAMETERS (GAMMAS)
C
      GAMSUM = 0.0
      NCST = NCON + NCAP
      DO 30  J = 1,NCONAC
         GAMMA(J) = AMAX1(GAMMA(J),0.0)
         IF(GAMMA(J).LE.0.0)  GO TO 30
         JJ = J + NPRDAC
         SCRTCH(J) = (X(JJ)-Z(J))**B(J)
         GAMMA(J) = SCRTCH(J) * GAMMA(J)**B(J)
         GAMSUM = GAMSUM + GAMMA(J)
   30 CONTINUE
      SOLNOM = SOLF(NCONAC,X(NCST),Z,GAMMA,B)
C
      DO 120  J = 1,NCON
         K = 0
C........SEARCH FOR ALL CAPITAL REQUIRED FOR PRODUCTION OF CONSUMABLE J
         DO 60  I = 1,NCAPM1
            IF(ITRADE(I) .NE. J)  GO TO 60
            RENTAL = ARENT(I) * X(NCAPM1+J)
            DLAMB(I) = RENTAL / R(I)
            K = K + 1
            INDEX(K) = I
   60    CONTINUE
         JCON = J + NCAPM1
         IF(K .EQ. 0)  GO TO 120
         IF(K .EQ. 2)  GO TO 70
         L = INDEX(K)
         GAMMAP(L) = 1.0
         BETA(L) = 0.0
         FUDGE(L) = 1.0
         CAPEFF = R(L)
         EFFLAB = DLAMB(L)
         GO TO 80
```

```
   70 CONTINUE
      J1 = INDEX(1)
      J2 = INDEX(2)
      IF(BETA(J1).GE.-1.0)  GO TO 75
      FACTOR = (DLAMB(J1)*R(J1)) / (DLAMB(J2)*R(J2))
      FACTOR = FACTOR / (FACTOR + 1.0)
      BETA(J1) = ALOG(FACTOR) / ALOG(-BETA(J1))
   75 CONTINUE
      BETA(J2) = BETA(J1)
      BETA0 = -BETA(J1)
      BETA1 = BETA(J1) + 1.0
      BETA2 = -1.0 / BETA(J1)
      GAMMAK = (R(J1)/R(J2))**BETA1 * (DLAMB(J1)/DLAMB(J2))
      GAMMAP(J1) = GAMMAK / (1.0 + GAMMAK)
      GAMMAP(J2) = 1.0 / (1.0 + GAMMAK)
      FUDGE(J1) = (R(J1)+R(J2)) / ((GAMMAP(J1)*R(J1)**BETA0 +
     *   GAMMAP(J2)*R(J2)**BETA0)**BETA2)
      FUDGE(J2) = FUDGE(J1)
      CAPEFF = R(J1) + R(J2)
      EFFLAM = (DLAMB(J1)*R(J1) + DLAMB(J2)*R(J2))
      EFFLAM = EFFLAM / CAPEFF
   80 CONTINUE
      XLABOR = X(JCON)*ARENT(JCON)
      ARENT(JCON) = XLABOR / CAPEFF
      IF(BETA(JCON).GE.-1.0)  GO TO 85
      FACTOR = EFFLAM * CAPEFF / XLABOR
      FACTOR = FACTOR / (FACTOR + 1.0)
      BETA(JCON) = -ALOG(FACTOR) / ALOG(-BETA(JCON))
   85 CONTINUE
      BETA0 = -BETA(JCON)
      BETA1 = 1.0 + BETA(JCON)
      BETA2 = -1.0 / BETA(JCON)
      GAMMAK = EFFLAM * (CAPEFF/XLABOR)**BETA1
      GAMMAP(JCON) = GAMMAK / (1.0 + GAMMAK)
      IF(GAMMAP(JCON) .GT. 0.999)  GAMMAP(JCON) = -1.0/(GAMMAK+1.0)
      GK = GAMMAP(JCON)
      GL = 1.0 - GAMMAP(JCON)
      IF(GAMMAP(JCON) .GT. 0.0)  GO TO 100
      GL = - GAMMAP(JCON)
      GK = 1.0 - GL
  100 CONTINUE
      FUDGE(JCON) = X(JCON) / ( (GK*CAPEFF**BETA0 +
     1   GL*XLABOR**BETA0)**BETA2 )
  120 CONTINUE
      DLAMB(NCAP) = 1.0
C
C..... PRINT TODAY'S ECONOMY
C
      WRITE(LP,2)
      CALL PRAR1(BETA(NCAP),NCON,15HBETA P-CONSUMBL,
     1    ACTLAB(1,NCAP),LP,132)
      CALL PRAR1(SCRTCH,NCONAC,15H UTILITY WEIGHT,ACTLAB(1,NCST),LP,132)
      CALL PRAR1(DLAMB,NCAP,15H   RENTAL VALUE,CAPLAB,LP,132)
      CALL PRAR1(GAMMAP(NCAP),NCON,15H FRACTN CAPITAL,
     1 ACTLAB(1,NCAP),LP,132)
      WRITE(LP,3)
```

```
      CALL PRARI(GAMMAP,NCAPM1,15HCAPITAL FRACINS,CAPLAB,LP,132)
      CALL PRARI(FUDGE,NCAPM1,15HNORMALIZE (K K),CAPLAB,LP,132)
      CALL PRARI(FUDGE(NCAP),NCON,15HNORMALIZE (ACT),
     1     ACTLAB(1,NCAP),LP,132)
      RETURN
      END
      SUBROUTINE EQUIRM(NCON,NCONP1,NCAP,NCST,NCAPM1,NFRDAC,NCONAC,NACT,
     1  R,X,Z,DLAMB,FLAM,EFFLAM,FUDGE,EFFCAP,EFFLAB,GAMMA,B,GAMMAP,BETA,
     2  ITRADE,D,ACON,DISCNT,DTAU,TLAG,TPER,SCRTCH,CAPLAB,CONLAB,
     3  ACTLAB,RENTLB,TCONS,PRMLAM)
C
      DIMENSION R(NCAP),X(NACT),DLAMB(NCAP),FLAM(NCST),EFFLAM(NCON),
     1  FUDGE(NFRDAC),EFFCAP(NCON),GAMMA(NCONAC),B(NCONAC),
     2  GAMMAP(NFRDAC),BETA(NFRDAC),Z(NCONAC),ITRADE(NCAPM1),D(NCAP),
     3  SCRTCH(NCST),DISCNT(NCAPM1),CAPLAB(3,NCAP),
     4  CONLAB(3,NCONP1),DTAU(NCAPM1),TLAG(NCAPM1),ACON(NCONP1,NACT),
     5  RENTLB(NCON),EFFLAB(NCON),TCONS(NCON),PRMLAM(NCON),
     6  ACTLAB(3,NACT)
C
      COMMON /DEVICE/ ITTY,INS,IDAT,LP,NRECNO
C
      DATA ERRTOL/0.005/
C
    1 FORMAT(/,1X,'CPU TIME TO CALCULATE EQUILIBRIUM ECONOMY =',F7.3,
     1 ' FOR ',I3,' ITERATIONS')
    2 FORMAT(1H0,25X,'PRODUCTIVITY VERSUS NORMALIZED LABOR TO CAPITAL ',
     1  'RATIO:',/)
    3 FORMAT(1H ,F7.2,1X,7(G15.7,1X))
    4 FORMAT(1H0,' RATIO  ',7(3A5,1X))
C
C     CALCULATES EQUILIBRIUM STATE FOR STUDY ECONOMY
C
      DO 10  J = 1,NCAPM1
        SCRTCH(J) = (EXP(-D(NCAP)*TLAG(J))) / (D(J) + D(NCAP))
   10 CONTINUE
      ITER = 0
      DLAMB(NCAP) = 1.0
      CALL UTILIZ(T1)
C
C     CALCULATE EQUILIBRIUM INVESTMENT ACTIVITY AND SET FLAM = COST
C
   20 CONTINUE
      ITER = ITER + 1
      CALL EFFKAP(EFFCAP,FUDGE,GAMMAP,BETA,ITRADE,R,NCON,NCAPM1)
   25 CONTINUE
      CALL XMIT(-NCON,0.0,EFFLAM)
      DO 40  J = 1,NCAPM1
         X(J) = R(J) / SCRTCH(J)
         FLAM(J) = 0.0
         DO 30  I = 1,NCON
            II = I + NCAP
            FLAM(J) = FLAM(J) + ACON(I,J)*FLAM(II)
   30    CONTINUE
         FLAM(J) = FLAM(J) + ACON(NCONP1,J)
         RHO = DISCNT(J) + D(J) + D(NCAP)
         RHOO = DISCNT(J) + D(NCAP)
         DLAMB(J) = FLAM(J) * RHO * EXP(RHOO*TLAG(J))
         I = ITRADE(J)
         EFFLAM(I) = EFFLAM(I) + DLAMB(J)*R(J) / EFFCAP(I)
   40 CONTINUE
```

```
C
C     CALCULATE LABOR
C
      CSTLAB = DLAMB(NCAP)
      SUML = 0.0
      DO 60  I = 1,NCON
         II = I + NCAPM1
         GK = GAMMAP(II)
         GL = 1.0 - GK
         IF(GK .GT. 0.0)  GO TO 45
         GL = -GK
         GK = 1.0 - GL
   45    CONTINUE
         BETA0 = BETA(II)
         BETA1 = 1.0 / (BETA0+1.0)
         BETA2 = (BETA0+1.0) / BETA0
         RATIO = ( (GL*EFFLAM(I))/(GK*CSTLAB) )**BETA1
         EFFLAB(I) = RATIO*EFFCAP(I)
         SUML = SUML + EFFLAB(I)
         PRMLAM(I) = (EFFLAM(I)/(GK*FUDGE(II)))*
     1      (GL/(RATIO**BETA0) + GK)**BETA2
         DO 50  J = 1,NCON
            PRMLAM(I) = PRMLAM(I) + ACON(J,II)*FLAM(J+NCAP)
   50    CONTINUE
         PRMLAM(I) = PRMLAM(I) + ACON(NCONP1,II) -
     1      ACON(I,II)*FLAM(I+NCAP)
   60 CONTINUE
      X(NCST) = R(NCAP) - SUML
      DLAMB(NCAP) = GAMMA(1) / ((X(NCST)-Z(1))**B(1))
C
C     CHECK FOR CONSISTENCY IN FLAM'S
C     USE PRMLAM ARRAY TO STORE NEW DERIVED FLAM
C
      IFLAG = -1
      DIF = DLAMB(NCAP) - CSTLAB
      AVG = (DLAMB(NCAP) + CSTLAB) / 2.0
      IF(ABS(DIF)/AVG .LE. ERRTOL)  GO TO 65
      IFLAG = +1
      DLAMB(NCAP) = AVG
   65 CONTINUE
      DO 75  I = 1,NCON
         II = I + NCAPM1
         JJ = I + NCAP
         XLAM = PRMLAM(I) / (1.0-ACON(I,II))
         DIF = FLAM(JJ) - XLAM
         AVG = (FLAM(JJ)+XLAM)/2.0
         IF(ABS(DIF)/AVG .GT. ERRTOL)  IFLAG = +1
         PRMLAM(I) = XLAM
   75 CONTINUE
      IF(IFLAG.LT.0)  GO TO 85
      DO 80  I = 1,NCON
         JJ = I + NCAP
         FLAM(JJ) = 0.5 * (PRMLAM(I)+FLAM(JJ))
   80 CONTINUE
      GO TO 25
C
   85 CONTINUE
```

```
C
C     CALCULATE PRODUCTION OF CONSUMABLES ACTIVITIES
C
      CALL XMIT(-NCON,0.0,TCONS)
      DO 100  I = 1,NCON
         II = I + NCAPM1
         GK = GAMMAP(II)
         GL = 1.0 - GK
         IF(GK .GT. 0.0)  GO TO 90
         GL = -GK
         GK = 1.0 - GL
   90    CONTINUE
         X(II) = 0.0
         IF(EFFCAP(I).LE.0.0 .OR. EFFLAB(I).LE.0.0)  GO TO 100
         X(II) = GK * EFFCAP(I)**(-BETA(II))
         X(II) = X(II) + GL * EFFLAB(I)**(-BETA(II))
         X(II) = FUDGE(II) * (X(II)**(-1.0/BETA(II)))
         DO 95  J = 1,NCON
            TCONS(J) = TCONS(J) + ACON(J,II)*X(II)
   95    CONTINUE
  100 CONTINUE
C
C     NEXT CALCULATE CONSUMPTION ACTIVITIES
C
      DO 120  JJ = 2,NCONAC
         J = JJ + NPRDAC
         X(J) = 0.0
         IF(GAMMA(JJ) .LE. 0.0)  GO TO 120
         COST = 0.0
         DO 110  I = 1,NCON
         IT = I + NCAP
         COST = COST + ACON(I,J)*FLAM(IT)
  110    CONTINUE
         COST = COST + ACON(NCONP1,J)
         IF(COST .LE. 0.0)  GO TO 120
         X(J) = (GAMMA(JJ)/COST)**(1.0/B(JJ)) + Z(JJ)
         DO 115  I = 1,NCON
            TCONS(I) = TCONS(I) + X(J)*ACON(I,J)
  115    CONTINUE
  120 CONTINUE
C
C     FIND USED FOR PRODUCTION OF CAPITAL ACTIVITIES
C
      DO 140  I = 1,NCAPM1
         DO 130  J = 1,NCON
            TCONS(J) = TCONS(J) + X(I)*ACON(J,I)
  130    CONTINUE
  140 CONTINUE
C
C     UNDIFFERENTIATED IMPORTS
C
```

```
      UNDIMF = 0.0
      NACTM1 = NACT - 1
      DO 150  I = 1,NACTM1
         UNDIMF = UNDIMF + ACON(NCONP1,I)*X(I)
  150 CONTINUE
      X(NACT) = 0.0
      IF(UNDIMF .LE. 00)  GO TO 170
      X(NACT) = -UNDIMF / ACON(NCONP1,NACT)
      DO 160  I = 1,NCON
         TCONS(I) = TCONS(I) + ACON(I,NACT)*X(NACT)
  160 CONTINUE
  170 CONTINUE
C
C     CHECK OUT ACTIVITIES TO SEE IF PRODUCED ENOUGH
C
      IFLAG = -1,
      DO 180  I = 1,NCON
         II = I + NCAPM1
         DIF = TCONS(I) - X(II)
         AVG.= X(II) + TCONS(I)
         IF(ABS(DIF)/AVG .GT. ERRTOL)  IFLAG = +1
         DO 175  J = 1,NCAPM1
            IF(ITRADE(J) .NE. I)  GO TO 175
            R(J) = R(J) * (1.0 + DIF/AVG)
  175    CONTINUE
  180 CONTINUE
      IF(IFLAG.GT.0)  GO TO 20
C
C     CONVERGENCE
C
      CALL UTILIZ(T2)
      CPU = T2 - T1
      WRITE(ITTY,1) CPU,ITER
C
      FLAM(NCAP) = DLAMB(NCAP)
C
C..... PRINT EQUILIBRIUM ECONOMY
C
      CALL PRARI(GAMMA,NCONAC,15H UTILITY WEIGHT,ACTLAB(1,NCST),LP,132)
      CALL PRARI(R,NCAP,15H      INVENTORY,CAPLAB,LP,132)
      CALL PRARI(X,NACT,15H     ACTIVITIES,ACTLAB,LP,132)
      CALL PRARI(FLAM,NCAP,15H  CAPITAL VALUE,CAPLAB,LP,132)
      CALL PRARI(FLAM(NCAP+1),NCON,15HCONSUMABL VALUE,CONLAB,LP,132)
      CALL PRARI(DLAMB,NCAP,15H   RENTAL VALUE,CAPLAB,LP,132)
C
      WRITE(LP,2)
      DO 600  INDEX = 1,NCON,7
      JSTART = INDEX
      JSTOP = INDEX + 6
      JSTOP = MINO(JSTOP,NCON)
      WRITE(LP,4) ((CONLAB(I,J),I=1,3),J=JSTART,JSTOP)
      DO 500  I = 1,37
```

```
      F = I
      IF(I .LE. 10)  F = F / 100.
      IF(I .GT. 10 .AND. I .LE. 19)  F = (F-9.0)/10.
      IF(I .GT. 19 .AND. I .LE. 28)  F = F-18.0
      IF(F .GT. 28)  F = (F-27.0)*10.
      DO 480  J = JSTART,JSTOP
         JJ = J + NCAPM1
         GK = GAMMAF(JJ)
         GL = 1.0 - GK
         IF(GK .GT. 0.0)  GO TO 450
         GL = -GK
         GK = 1.0 - GL
450      CONTINUE
         XNOR = (GK + GL*RENTLB(J)**(-BETA(JJ)))**(-1.0/BETA(JJ))
         XFAC = (GK + GL*(F*RENTLB(J))**(-BETA(JJ)))**(-1.0/BETA(JJ))
         SCRTCH(J) = XFAC/XNOR
480   CONTINUE
      WRITE(LP,3) F,(SCRTCH(J),J=JSTART,JSTOP)
500 CONTINUE
600 CONTINUE
    RETURN
    END
    SUBROUTINE TIMPER(NCON,NCAP,NCAPM1,NCST,NFRDAC,NCONAC,NACT,NPER,
  1  NCONP1,NPERP1,NPERP2,R,RLAST,GROWTH,
  2  D,T,TLAG,DTAU,DLAMB,FLAM,RTRGT,RFUT,X,Z,GAMMA,B,ITRADE,FUDGE,
  3  EFFCAP,EFFLAB,ACON,KSTART,SCRTCH,
  4  EFFCST,EFFLAM,TCONS,REQ,PRMLAM,RSCALE)
C
C   SOLVES EACH TIME PERIOD FOR GIVEN PASS AND PROPAGATES RESOURCES
C
    DIMENSION R(NCAP,NPERP2),RLAST(NCAP,NPERP2),GROWTH(NCAPM1),
  1  D(NCAP),T(NPERP2),TLAG(NCAPM1),DTAU(NCAPM1),REQ(NCAP),
  2  DLAMB(NCAP,NPER),FLAM(NCST,NPERP1),RTRGT(NCAPM1),X(NACT,NPER),
  3  Z(NCONAC),GAMMA(NACT),B(NACT),KSTART(NCAP),SCRTCH(NCST),
  4  ITRADE(NCAPM1),FUDGE(NFRDAC),EFFCAP(NCON),EFFLAB(NCON),
  5  ACON(NCONP1,NACT),PRMLAM(NCON),RFUT(NCAPM1),RSCALE(NCAPM1),
  6  EFFLAM(NCON),TCONS(NCON),EFFCST(NCAPM1,NPER)
C
    LOGICAL EVERET
    LOGICAL PRNTFS
C
    COMMON /EVERET/ EVERET
    COMMON/ LOOP / ITER,LOOP
    COMMON /MERIT/ FOM,FOM2
    COMMON /MIXER/ RESMIX
    COMMON /PASS/ IPASS
    COMMON /PERIOD/ IPER
    COMMON/ PRINTF /PRNTFS
    COMMON /DEVICE/ ITTY,INS,IDAT,LP,NRECNO
    COMMON /SLOPE/ SLPMLT,MAXITR
    COMMON /TOLRNC/ ERRTOL
C
```

```
    1 FORMAT(1H0,15('  '),' INPUT FOR PERIOD ',I3)
    2 FORMAT(1H ,6X,'R',10G12.4)
    3 FORMAT(1H ,3X,'FLAM',10G12.4)
    4 FORMAT(1H ,2X,'ICONS',10G12.4)
    5 FORMAT(1H ,2X,'RTRGT',10G12.4)
    6 FORMAT(1H ,2X,'XTRGT',10G12.4)
    7 FORMAT(1H ,15(' '),' OUTPUT FROM PERIOD ',I3)
    8 FORMAT(1H1,11('-'),' BEGIN PASS NO.'I3,' ',11('-'))
    9 FORMAT(1H ,2X,'DLAMB',10G12.4)
   10 FORMAT(1H ,6X,'X',10G12.4)
   11 FORMAT(1H ,3X,'RFUT',10G12.4)
   12 FORMAT(1H ,1X,'EFFCST',10G12.4)
   13 FORMAT(1H ,2X,'LABOR',10G12.4)
   14 FORMAT(1H ,1X,'LAMPRM',10G12.4)
   15 FORMAT(1H ,'EPSILON',10G12.4)
   16 FORMAT(1H ,'LOOPS = ',I5)
C
      LOOP = 0
      SUM1 = 0.0
      SUM2 = 0.0
      NCAPP1 = NCAP + 1
      DO 220  K = 1,NPERP2
        DO 200  J = 1,NCAPM1
          R(J,K) = RSTART(J)*EXP(GROWTH(J)*T(K))
          IF(T(K) .GT. TLAG(J))  R(J,K) = RSTART(J) * EXP( GROWTH(J)*
     *      TLAG(J) - (D(J)+D(NCAP))*(T(K)-TLAG(J)) )
  200   CONTINUE
        R(NCAP,K) = RSTART(NCAP)
  220 CONTINUE
      IF(PRNTPS)  WRITE(LP,8)  IPASS
C
      DO 500  K = 1,NPER
      K1 = K + 1
C
      IF(EVERET)  GO TO 305
C
      DO 300  J = 1,NCAPM1
         IF(IPASS .NE. 1)  GO TO 240
         IF(K .EQ. 1)  GO TO 250
         CALL  XMIT(NCON,X(NCAP,K-1),X(NCAP,K))
C        CALL  XMIT(NCON,FLAM(NCAP+1,K),FLAM(NCAP+1,K1))
         GO TO 250
  240    CONTINUE
         R(J,K) = (R(J,K) + RLAST(J,K)*(RESMIX-1.0)) / RESMIX
  250    CONTINUE
C..... SET FUTURE RESOURCE LEVEL --
        KK = (T(K1) + 1.5*TPER + TLAG(J))/TPER + 0.001
        RFUT(J) = R(J,KK) * EXP(+(D(J)+D(NCAP))*(TPER/2.0 + DTAU(J)) )
C..... SET RESOURCE TARGET
         DIF = RLAST(J,KK) - RLAST(J,KK-1)
         IF(DIF .GE. 0.0)  RTRGT(J) = RLAST(J,KK) +
     1    DIF/TPER * (TPER/2.0+DTAU(J))
         IF(DIF.LT.0.0)  RTRGT(J) = RLAST(J,KK) * EXP(
     1    ALOG(RLAST(J,KK-1)/RLAST(J,KK)) * (TPER/2. + DTAU(J)))
         FACTR = EXP(-D(NCAP)*TLAG(J))*(1.0-EXP(-(D(J)+D(NCAP))*TPER))/
     *     (D(J)+D(NCAP))
```

```
            FACTR = TPER / FACTR
C...... SET RFUT      COMBO OF RFUT AND RTRGT
            RFUT(J) = RTRGT(J)*(1.0-FACTR) + RFUT(J)*FACTR
            SCRTCH(J) = RTRGT(J) - RFUT(J)
  300 CONTINUE
C
  305 CONTINUE
      IF(.NOT. PRNTPS)  GO TO 310
      WRITE(LP,1) K
      WRITE(LP,2) (R(L,K),L=1,NCAP)
      WRITE(LP,3) (FLAM(L,K1),L=1,NCST)
      IF(.NOT.EVERET)  WRITE(LP,5) RTRGT
      IF(.NOT.EVERET)  WRITE(LP,11) RFUT
      IF(.NOT.EVERET)  WRITE(LP,6) (SCRTCH(L),L=1,NCAPM1)
  310 CONTINUE
      CALL ACTVTY(NCON,NCONP1,NCAP,NCAPM1,NCST,NPRDAC,NCONAC,NACT,
     1  GAMMA,B,GAMMA(NCST),B(NCST),FLAM(1,K1),RTRGT,RFUT,EFFCST(1,K),
     2  EFFLAM,X(1,K),Z,FUDGE,R(1,K),EFFCAP,EFFLAB,ITRADE,ACON,
     3  BLAMB(1,K),SCRTCH,TCONS,PRMLAM,KEQ,RSCALE)
      LOOP = LOOP + ITER
      DO 320  J = 1,NCAPM1
         SUM1 = SUM1 + ((EFFCST(J,K)-FLAM(J,K1)) / (0.5*(EFFCST(J,K)+
     1       FLAM(J,K1))))**2  * X(J,K)
         SUM2 = SUM2 + X(J,K)
  320 CONTINUE
      IF(.NOT. PRNTPS)  GO TO 335
      WRITE(LP,7) K
      WRITE(LP,9)  (BLAMB(L,K),L=1,NCAP)
      WRITE(LP,10)  (X(L,K),L=1,NACT)
      WRITE(LP,3)  (FLAM(L,K1),L=1,NCST)
      WRITE(LP,12)  (EFFCST(J,K),J=1,NCAPM1)
      WRITE(LP,13) EFFLAB
      WRITE(LP,14) PRMLAM
      WRITE(LP,4)  TCONS
      WRITE(LP,15)  (SCRTCH(J),J=1,NCON)
      WRITE(LP,16) ITER
  335 CONTINUE
      IF(IPASS.EQ.1 .AND. SUM2.LE.0.0)  RETURN
C
C     PROPAGATE DELTA RESOURCES FORWARD
C
      DO 400  J = 1,NCAPM1
        DO 360  KK = K,NPERP2
          R(J,KK) = R(J,KK) + X(J,K) * EXP(-B(NCAP)*TLAG(J)) *
     *       EXP( (B(J)+B(NCAP))*AMAX1(0.0,T(KK)-T(K1)-TLAG(J)+TPER/2.))
     *       *(1.0 - EXP(-(B(J)+B(NCAP))*AMIN1(TPER,AMAX1(0.0,
     *       T(KK)-T(K)-TLAG(J)+TPER/2.0)))) / (B(J)+B(NCAP))
  360   CONTINUE
  400 CONTINUE
  500 CONTINUE
      FOM2 = 999.
      IF(SUM2.GT.0.0)  FOM2 = SQRT(SUM1/SUM2)
      IF(IPASS.EQ.1 .OR. EVERET)  RETURN
      DO 560  K = NPERP1,NPERP2
      DO 550  J = 1,NCAPM1
        R(J,K) = (R(J,K)+RLAST(J,K)*(RESMIX-1.0))/RESMIX
  550 CONTINUE
  560 CONTINUE
```

```
      RETURN
      END
      SUBROUTINE ACTV2 (NCON,NCONF1,NCAP,NCAPM1,NCST,NFRDAC,NCONAC,NACT,
     1  GAMMAP,BETA,GAMMA,R,FLAM,KIRGT,RFUT,EFFCST,EFFLAM,X,Z,FUDGE,
     2  K,EFFCAP,EFFLAB,ITRADE,ACON,BLAMB,SCRTCH,TCONS,
     3  FRMLAM,RER,RSCALE)
C
C     CALCULATES ACTIVITIES AND SHADOW VALUES FOR CONSUMABLES GIVEN
C     RESOURCES, OBJECTIVE FUNCTIONS, AND CAPITAL SHADOW VALUES
C
      DIMENSION GAMMAP(NFRDAC),BETA(NFRDAC),GAMMA(NCONAC),R(NCONAC),
     1  FLAM(NCST),KIRGT(NCAPM1),RFUT(NCAPM1),EFFCST(NCAPM1),
     2  EFFLAM(NCON),X(NACT),Z(NCONAC),FUDGE(NFRDAC),K(NCAP),
     3  EFFCAP(NCON),EFFLAB(NCON),ACON(NCONF1,NACT),BLAMB(NCAP),
     4  ITRADE(NCAPM1),SCRTCH(NCON),TCONS(NCON),FRMLAM(NCON),
     5  RER(NCAPM1),RSCALE(NCAPM1)
C
      LOGICAL EVERET
C
      COMMON /EVERET/ EVERET
      COMMON /LOOP/  ITER,LOOP
      COMMON /PASS/ IPASS
      COMMON /PERIOD/ IPER
      COMMON /SLOPE/ SLPMLT,MAXITR
      COMMON /TOLRNC/ ERRTOL
C
      CALL XMIT(-NCON,10.*ERRTOL,SCRTCH)
      CALL EFFKAP(EFFCAP,FUDGE,GAMMAP,BETA,ITRADE,R,NCON,NCAPM1)
      TOTLAB = 0.0
      DO 15  I = 1,NCON
         II = I + NCAPM1
         EFFLAB(I) = 0.0
         IF(X(II) .LE. 0.0)  GO TO 15
         GK = GAMMAP(II)
         GL = 1.0 - GK
         IF(GK .GT. 0.0)  GO TO 10
         GL = -GK
         GK = 1.0 - GL
   10    CONTINUE
         B1 = -BETA(II)
         B2 = 1.0 / BETA(II)
         B3 = -B2
         ACTMAX = FUDGE(II)*EFFCAP(I)*GK**B3
         X(II) = AMIN1(X(II),0.99*ACTMAX)
         FACTOR = X(II) / (FUDGE(II)*EFFCAP(I))
         FAC1 = GL / (FACTOR**B1 - GK)
         EFFLAB(I) = EFFCAP(I) * FAC1**B2
         TOTLAB = TOTLAB + EFFLAB(I)
   15 CONTINUE
      IF(TOTLAB .LT. K(NCAP))  GO TO 17
      FACTOR = 0.9*K(NCAP)/TOTLAB
      DO 16  I = 1,NCON
         EFFLAB(I) = EFFLAB(I) * FACTOR
   16 CONTINUE
   17 CONTINUE
C
      ITER = 0
      DELTA = 0.6
      FCONS = 0.25
```

```
C
   50 CONTINUE
      ITER = ITER + 1
C
C     CALCULATE DLAMB AND LAMBDA PRIME FOR PROD. OF CONSUMABLES
C
   30 CONTINUE
      SUML = 0.0
      CALL XMIT(-NCON,0.0,TCONS)
      DO 70  I = 1,NCON
         II = I + NCAPM1
         X(II) = 0.0
         PRMLAM(I) = 0.0
         IF(EFFLAB(I) .LE. 0.0)  GO TO 70
         GK = GAMMAP(II)
         GL = 1.0 - GK
         IF(GK .GT. 0.0)  GO TO 45
         GL = -GK
         GK = 1.0 - GL
   45    CONTINUE
         B1 = -BETA(II)
         B2 = 1.0/B1
         B3 = B1 - 1.0
         X(II) = FUDGE(II) * (GK*EFFCAP(I)**B1 + GL*EFFLAB(I)**B1)**B2
         SUML = SUML + EFFLAB(I)
         DO 60  J = 1,NCON
            TCONS(J) = TCONS(J) + ACON(J,II)*X(II)
   60    CONTINUE
   70 CONTINUE
      X(NCST) = R(NCAP) - SUML
      DLAMB(NCAP) = GAMMA(1) / ((X(NCST)-Z(1))**B(1))
      FLAM(NCAP) = DLAMB(NCAP)
      DO 75  I = 1,NCON
         II = I + NCAPM1
         GK = GAMMAP(II)
         GL = 1.0 - GK
         IF(GK .GT. 0.0)  GO TO 72
         GL = -GK
         GK = 1.0 - GL
   72    CONTINUE
         BETA0 = BETA(II)
         BETA1 = BETA0 + 1.0
         BETA2 = (BETA0+1.0) / BETA0
         EFFLAM(I) = (GK*DLAMB(NCAP)/GL) *
     1      (EFFLAB(I)/EFFCAP(I))**BETA1
         PRMLAM(I) = (DLAMB(NCAP)/(GL*FUDGE(II)))*
     1      (GK*(EFFLAB(I)/EFFCAP(I))**BETA0 + GL)**BETA2
   75 CONTINUE
C
C     CHECK CONSISTENCY IN FLAM'S
C     (TEMPORARILY STORE OLD FLAM'S IN EFFCST)
C
   80 CONTINUE
      IFLAG = 1
      CALL XMIT(NCON,FLAM(NCAP+1),EFFCST)
      DO 90  I = 1,NCON
         II = I + NCAPM1
         JJ = I + NCAP
         SUM = 0.0
         DO 85  J = 1,NCON
```

```
                 IF(J.EQ.I)  GO TO 85
                 SUM = SUM + ACON(J,II)*EFFCST(J)
   85         CONTINUE
              SUM = SUM + ACON(NCONP1,II)
              XLAM = (FRMLAM(I)+SUM) / (1.0-ACON(I,II))
              DIF = FLAM(JJ) - XLAM
              AVG = FLAM(JJ) + XLAM
              IF(ABS(DIF)/AVG .GT. ERRTOL)  IFLAG = 11
              FLAM(JJ) = 0.5*(FLAM(JJ) + XLAM)
   90 CONTINUE
      IF(IFLAG.GT.0.0)  GO TO 80
C
C     FIND EFFECTIVE COST FOR PRODUCING CAPITAL
C
      DO 105  J = 1,NCAPM1
         EFFCST(J) = 0.0
         DO 100  I = 1,NCON
            II = I + NCAP
            EFFCST(J) = EFFCST(J) + ACON(I,J)*FLAM(II)
  100    CONTINUE
         EFFCST(J) = EFFCST(J) + ACON(NCONP1,J)
  105 CONTINUE
C
C     NEXT CALCULATE CONSUMPTION ACTIVITIES
C
      DO 120  JJ = 2,NCONAC
         J = JJ + NFRDAC
         X(J) = 0.0
         IF(GAMMA(JJ) .LE. 0.0)  GO TO 120
         COST = 0.0
         DO 110  I = 1,NCON
         II = I + NCAP
         COST = COST + ACON(I,J)*FLAM(II)
  110    CONTINUE
         COST = COST + ACON(NCONP1,J)
         IF(COST .LE. 0.0)  GO TO 120
         X(J) = (GAMMA(JJ)/COST)**(1.0/B(JJ)) + Z(JJ)
         DO 115  I = 1,NCON
            TCONS(I) = TCONS(I) + X(J)*ACON(I,J)
  115    CONTINUE
  120 CONTINUE
C
C     FIND USED FOR PRODUCTION OF CAPITAL ACTIVITIES
C
      DO 140  I = 1,NCAPM1
         IF(EVERET)  GO TO 125
         RSCL = RSCALE(I) * SLPMLT*R(I)/REQ(I)
         X(I) = RTRGT(I)-REQT(I) - RSCL*ALOG(EFFCST(I)/FLAM(I))
         X(I) = X(I) / TPER
         X(I) = AMAX1(X(I),0.0)
  125    CONTINUE
         DO 130  J = 1,NCON
            TCONS(J) = TCONS(J) + X(I)*ACON(J,I)
  130    CONTINUE
  140 CONTINUE
C
C     UNDIFFERENTIATED IMPORTS
```

```
C
      UNDIMP = 0.0
      NACTM1 = NACT - 1
      DO 150  I = 1,NACTM1
         UNDIMP = UNDIMP + ACON(NCONP1,I)*X(I)
  150 CONTINUE
      X(NACT) = 0.0
      IF(UNDIMP .LE. 0.0)  GO TO 160
      X(NACT) =  UNDIMP / ACON(NCONP1,NACT)
      DO 155  I = 1,NCON
         TCONS(I) = TCONS(I) + ACON(I,NACT)*X(NACT)
  155 CONTINUE
  160 CONTINUE
C
C     CALCULATE DELTA LAMBDAS (RENTAL OF CAPITAL)
C
      DO 170  I = 1,NCON
         DO 165  J = 1,NCAPM1
            IF(ITRADE(J).NE.I)  GO TO 165
            DLAMB(J) = EFFLAM(I)*FUDGE(J)*GAMMAP(J)*((EFFCAP(I)/
     1         (FUDGE(J)*R(J)))**(BETA(J)+1.0))
  165    CONTINUE
  170 CONTINUE
C
C     CHECK OUT ACTIVITIES TO SEE IF PRODUCED ENOUGH
C
      IFLAG = -1
      JFLAG = -1
      SUML = 0.0
      DO 200  I = 1,NCON
         II = I + NCAPM1
         GK = GAMMAP(II)
         IF(GK .LT. 0.0)  GK = 1.0 + GK
         BETAO = -1.0 / BETA(II)
         ACTMAX = 0.98*FUDGE(II)*EFFCAP(I)*GK**BETAO
         DIF = TCONS(I) - X(II)
         AVG = TCONS(I) + X(II)
         IF(ABS(DIF)/AVG.GT.ERRTOL)  IFLAG = +1
         IF(ABS(SCRTCH(I)).GT.ERRTOL)  JFLAG = +1
         FO = -DELTA
         IF(SCRTCH(I)*DIF .GT. 0.0)  FO = FCONS*DELTA
         IF(ITER .EQ. 1)  FO = 0.0
         SCRTCH(I) = ABS(SCRTCH(I)) * (1.0+FO)
         SCRTCH(I) = AMIN1(SCRTCH(I),0.9)
         SCRTCH(I) = SIGN(SCRTCH(I),DIF)
  200 CONTINUE
      IF(JFLAG.LT.0)  IFLAG = -1
      IF(IFLAG.LT.0 .OR. ITER.GT.MAXITR)  GO TO 250
      DO 201  I = 1,NCON
         FRMLAM(I) = FRMLAM(I)*(1.0+SCRTCH(I))
  201 CONTINUE
      DO 220  I = 1,NCON
         II = I + NCAPM1
         GK = GAMMAP(II)
         GL = 1.0 - GK
         IF(GK .GT. 0.0)  GO TO 205
         GL = -GK
         GK = 1.0 - GL
  205    CONTINUE
```

```
            FACTOR = FUDGE(I)*GL*FRNLAM(I)/FRNLAMB(NCAP)
            B1 = BETA(I) / (BETA(I) + 1.0)
            B2 = 1.0/BETA(I)
            FACTOR = (FACTOR**B1 - GL)/GK
            EFFLAB(I) = 0.0
            IF(FACTOR .GT. 0.0)  EFFLAB(I) = EFFCAP(I) *
     1         FACTOR**B2
            SUML = SUML + EFFLAB(I)
  220    CONTINUE
         IF(SUML .LT. R(NCAP))  GO TO 20
         FACTOR = 0.99*R(NCAP)/SUML
         DO 225  I = 1,NCON
            EFFLAB(I) = FACTOR*EFFLAB(I)
  225    CONTINUE
         GO TO 20
  250    CONTINUE
         RETURN
         END
         SUBROUTINE EFFKAP(EFFCAP,FUDGE,GAMMA,BETA,ITRADE,K,NCON,NCAPM1)
         DIMENSION EFFCAP(NCON),GAMMA(NCAPM1),BETA(NCAPM1),ITRADE(NCAPM1),
     1   K(NCAPM1),FUDGE(NCAPM1),INDEX(2)
C
C        THIS SUBROUTINE OBTAINS AN EFFECTIVE LEVEL OF CAPITAL FOR USE
C        IN THE PRODUCTION OF THE NCON CONSUMABLES BY USING A TRANSLOG
C        FUNCTION TO TRADE OFF TWO TYPES OF CAPITAL.
C
         DO 100  J = 1,NCON
            K = 0
            DO 20  I = 1,NCAPM1
               IF(ITRADE(I) .NE. J)  GO TO 20
               K = K + 1
               INDEX (K) = I
   20       CONTINUE
            EFFCAP(J) = 0.0
            IF(K .EQ. 0)  GO TO 100
            IF(K .EQ. 2)  GO TO 40
            J1 = INDEX(1)
            EFFCAP(J) = R(J1)
            GO TO 100
   40       CONTINUE
            J1 = INDEX(1)
            J2 = INDEX(2)
            G1 = GAMMA(J1)
            G2 = GAMMA(J2)
C........NOTE THAT G2 ALSO EQUALS 1.0-G1 ....
            F = FUDGE(J1)
C........BETA = BETA(J1) = BETA(J2) .....
            EFFCAP(J) = F*(G1*R(J1)**(-BETA(J1)) + G2*R(J2)**(-BETA(J2)))
     1         **(-1.0/BETA(J1))
  100    CONTINUE
         RETURN
         END
```

```
      SUBROUTINE LAMBAC(NPER,NCAP,NCAPM1,NCST,NPERP1,NPERP2,I,D,FLAM,
     1  DLAMB,TLAG,DTAU,DISCNT,EFFCST,R,REQ,IFLAG)
C
      DIMENSION I(NPERP1),D(NCAP),FLAM(NCST,NPERP1),DLAMB(NCAP,NPER),
     1  TLAG(NCAPM1),DTAU(NCAPM1),DISCNT(NCAPM1),EFFCST(NCAPM1,NPER),
     2  R(NCAP,NPER),REQ(NCAPM1)
C
      COMMON /PERIOD/ TPER
C
C
C PROPAGATES LAMBDAS BACKWARDS THROUGH TIME --
C NOTE:  IFLAG CONTROLS WHETHER LAMBDAS ARE PROPAGATED ALL THE WAY BACK
C OR ONLY TO FLAM(J,2).  NORMALLY, FLAM(J,1) IS USED TO STORE THE
C HORIZON DLAMB, BUT ON THE LAST PASS, THIS IS NO LONGER
C NECESSARY, AND FLAM FOR FIRST TIME PERIOD IS CALCULATED FOR PRINTING
C IN SUBROUTINE DRIVER.  THIS FIRST FLAM REPRESENTS THE IMMEDIATE
C POST ATTACK (POST RECONSTITUTION) FLAM ....
C
      KKLAST = NPER - 1
      IF(IFLAG .LE. 0)  KKLAST = NPER
      DO 200  J = 1,NCAPM1
C.....   FIRST CALCULATE HORIZON FLAM
         DLH = FLAM(J,1)
         RHO = DISCNT(J) + D(NCAP) + D(J)
         FLAMH = DLH * PROFL(1.0,1.0,1.0,0.0,TLAG(J),TPER,DTAU(J),
     1      D(J),D(NCAP),DISCNT(J))/(1.0-EXP(-RHO*TPER))
C.....   NEXT ESTIMATE FLAM FOR LAST TIME PERIOD
         KDEL = (TLAG(J) + 0.0001) / TPER
         KHOR = NPER + KDEL + 2
         RHOR = R(J,KHOR) * EXP(+(D(J)+D(NCAP))*(TPER/2. + DTAU(J)))
C.....   ABOVE SAME AS CALCULATION OF 'RFUT' IN TIMPER
         FLAM(J,NPERP1) = FLAMH * REQ(J) / RHOR
C.....   NEXT CALCULATE OTHER FLAMS BY PROPAGATING RENTAL VALUES
         DO 150  KK = 1,KKLAST
            K = NPERP1 - KK
            K0 = (K-1) + KDEL
            K1 = K0 + 1
            K2 = K0 + 2
            DL = DLH * REQ(J) / R(J,K0)
            DL1 = DLH * REQ(J) / R(J,K1)
            DL2 = DLH * REQ(J) / R(J,K2)
            IF(K0.LE.NPER)  DL = DLAMB(J,K0)
            IF(K1.LE.NPER)  DL1 = DLAMB(J,K1)
            IF(K2.LE.NPER)  DL2 = DLAMB(J,K2)
            FLAM(J,K) = PROFL(DL,DL1,DL2,  FLAM(J,K+1),TLAG(J),TPER,
     *      DTAU(J),D(J),D(NCAP),DISCNT(J))
  150    CONTINUE
  200 CONTINUE
      RETURN
      END
```

```
      FUNCTION PROFL(DL,DL1,DL2,FL,TAU,DELT,DTAU,D,P,R)
C
      PDR = P + D + R
      PDRT = EXP( PDR*DELT)
      PDRTAU = EXP( PDR*DTAU)
      RT = EXP( R*DELT)
      RTAU = EXP( R*DTAU)
      FACTOR = EXP( (PDR)*TAU) / ((PD)*(1.0 RT)/R)
C
      PROFL = FL*PDRT + FACTOR*(
     1          DL*( (1.0 RTAU)/R - (1.0-PDRTAU)/PDR ) +
     2         DL1*( (RTAU*(1.0+PDRT) - PDRT - RT)/R +
     +               (RT*(1.0-PDRTAU) + PDRT - PDRTAU)/PDR ) +
     3         DL2*( RT*(PDRTAU-PDRT)/PDR + PDRT*(RT-RTAU)/R ) )
C
      RETURN
      END
      SUBROUTINE PLTOUT(NCAP,NCON,NACT,NPER,
     1  SCRTCH,R,FLAM,EFFCST,DLAMB,X,CAPLAB)
      DIMENSION SCRTCH(5),R(1),FLAM(1),DLAMB(1),X(1),CAPLAB(1),EFFCST(1)
      COMMON /PERIOD/ TPER
      COMMON /DEVICE/ ITTY,INS,IDAT,LP,NRECNO
C
C     CREATE FILE FOR PLOTTING ROUTINES
C
      SCRTCH(1) = NCAP
      SCRTCH(2) = NCON
      SCRTCH(3) = NACT
      SCRTCH(4) = NPER
      SCRTCH(5) = TPER
      NPERP1 = NPER + 1
      NCST = NCAP + NCON
      NCSTP1 = NCST + 1
      NCAPM1 = NCAP - 1
      N1 = NCAP*NPERP1
      N2 = NCST*NPERP1
      N3 = NCAPM1*NPER
      N4 = NCAP*NPER
      N5 = NPER*NACT
      N6 = 3*(NCSTP1+NACT)
C..... NOTE ALL LABELS ARE TOGETHER NCAP + NCONP1 + NACT
      WRITE(5#NRECNO) (SCRTCH(I),I=1,5),(R(I),I=1,N1),
     #        (FLAM(I),I=1,N2),(EFFCST(I),I=1,N3),(DLAMB(I),I=1,N4),
     #        (X(I),I=1,N5),(CAPLAB(I),I=1,N6)
      NRECNO = NRECNO + 1
      RETURN
      END
      FUNCTION SOLF(NCONAC,X,Z,GAMMA,B)
C
C..... CALCULATES STANDARD OF LIVING BASED ON ACTIVITIES AND UTILITY
C       FUNCTION PARAMETERS
C
```

```
      DIMENSION X(NCONAC),Z(NCONAC),GAMMA(NCONAC),B(NCONAC)
      SOLF = 0.0
      DO 100  I = 1,NCONAC
         IF(GAMMA(I).LE.0.0)  GO TO 100
         IF(X(I)-Z(I).LE.0.0)  GO TO 200
         IF(B(I) .EQ. 1.0)  GO TO 20
         SOLO = ( (X(I)-Z(I))**(1.0-B(I)) - 1.0 ) / (1.0 - B(I))
         GO TO 50
   20    CONTINUE
         SOLO = ALOG(X(I)-Z(I))
   50    CONTINUE
         SOLF = SOLF + GAMMA(I)*SOLO
  100 CONTINUE
      RETURN
  200 CONTINUE
      SOLF = 0.0
      RETURN
      END
      SUBROUTINE STOPIT
      IMPLICIT INTEGER(A-Z)
      LOGICAL TYPEIN
      COMMON /DEVICE/ ITTY,INS,IDAT,LP,NRECNO
      DATA LCC,LCS/"615004020100,"715004020100/
      DATA UPC,UPS/5HC    ,5HS    /
      DATA BELL/"034000000000/
C
    1 FORMAT(' YOU HAVE INTERRUPTED ME --',/,
     *       ' Type C to let me continue or S to stop me.')
    2 FORMAT(A1)
    3 FORMAT(1X,/,' EXCUSE ME?',A1)
C
      IF(.NOT.TYPEIN(DUMMY))RETURN
  100 CONTINUE
      WRITE(ITTY,3)  BELL
      WRITE(ITTY,1)
      READ(ITTY,2)  REPLY
      IF(REPLY.EQ.UPS .OR. REPLY.EQ.LCS)  STOP
      IF(REPLY.EQ.UPC .OR. REPLY.EQ.LCC)  RETURN
      GO TO 100
      END
      SUBROUTINE SUMARY(NCST,NCAPM1,NACT,X,R,SUMMRY)
      DIMENSION X(NACT),R(NCAPM1),SUMMRY(5)
C
```

```
      NCSTP1 = NCST + 1
      NPRDAC = NCST - 1
      NCAP = NCAPM1 + 1
C
      CALL XMIT(-5,0.0,SUMMRY)
C
      DO 100  I = NCSTP1,NACT
         SUMMRY(1) = SUMMRY(1) + X(I)
  100 CONTINUE
      DO 200  I = 1,NCAPM1
         SUMMRY(2) = SUMMRY(2) + X(I)
  200 CONTINUE
      SUMMRY(3) = SUMMRY(1) + SUMMRY(2)
      DO 300  I = NCAP,NPRDAC
         SUMMRY(4) = SUMMRY(4) + X(I)
  300 CONTINUE
      DO 400  I = 1,NCAPM1
         SUMMRY(5) = SUMMRY(5) + R(I)
  400 CONTINUE
C
      RETURN
      END
```

```
TYPE BASI3.DAT.1
TYPE BASD XXX
```

LME